IBM WORLD

September 2, 1988

IBM's true stand on databases

DBMS spotlight

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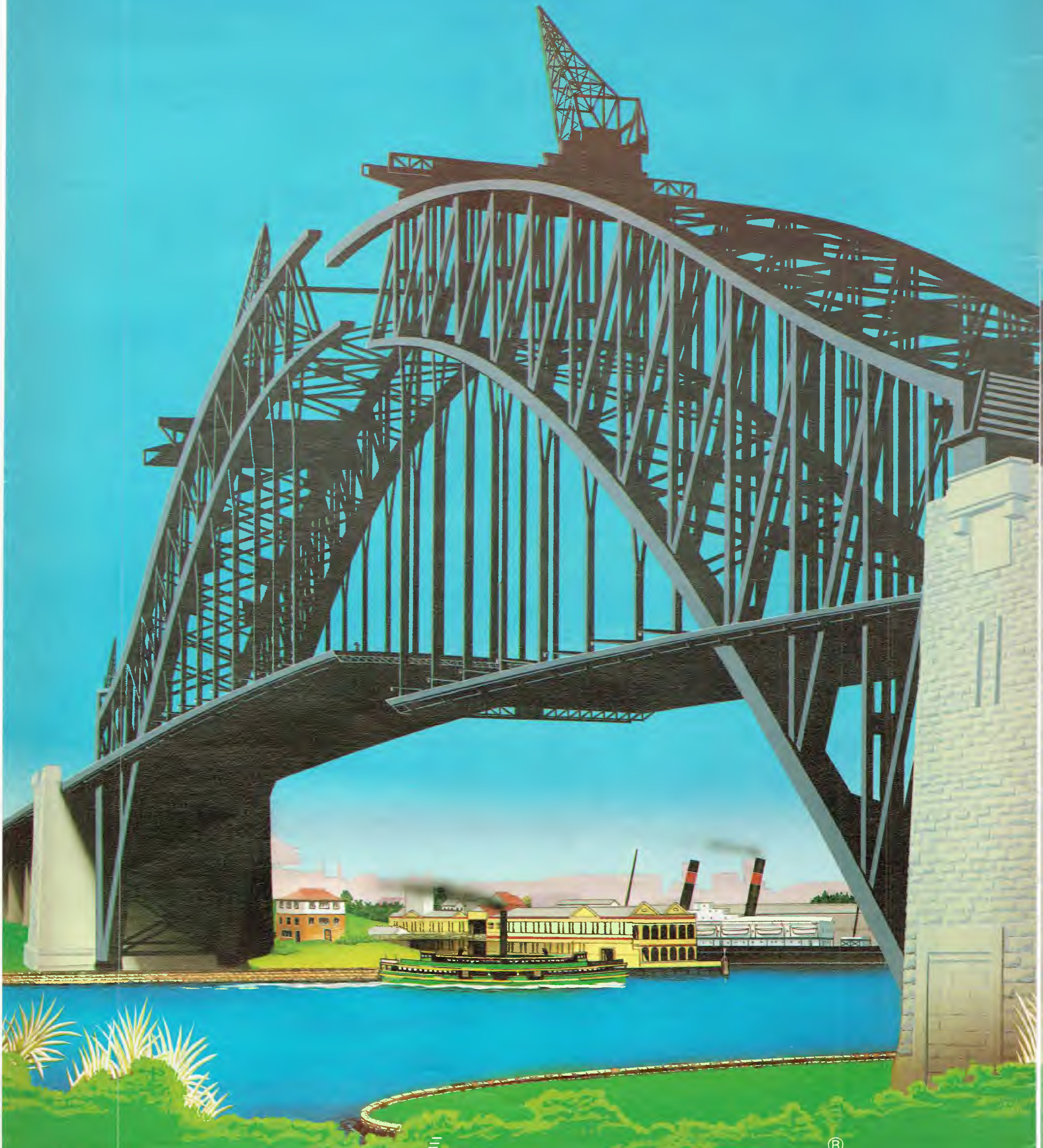

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IBM sets database pace

A standard has been set for relational performance that poses a threat to competitors, with much faster processing

☐ IBM is trying to open a whole new era of relational database use. It showed its hand to industry and users alike when it announced Version 2.0 of DB2 earlier this year. At the same time it tried to destroy the debate over relational performance for ever.

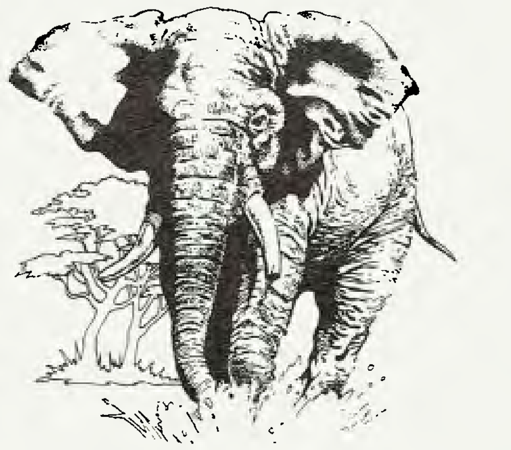
The relational approach brought a flexibility to the database field that its predecessors lacked. But the price of open ended access, many users suggested, was unpredictable performance. Even relational advocates admit that an SQL query may take either four minutes or four days, depending on how it is phrased.

IBM took a huge step toward overcoming that problem with Version 2.0 by including a resource governor. The database administrator may now impose restriction on how long a query will run and the number of CPU cycles it will consume. Offering this level of control over DB2 removes one of the hangups of using relational databases in production evironments.

Indeed, with its much faster transaction processing capabilities, IBM has set a standard for relational performance that threatens to leave its competitors far behind.

In the past IBM has had little cause to be self-congratulatory about its software once it gets beyond operating systems and utilities. But with DB2 2.0, it has advanced the state of the art of relational database.

To a great extent, IBM's announcement of ESA/370, an extension of the MVS/XA operating system, was spadework for a later DB2 announcement. By expanding the capability of virtual memory from 2G-bytes to 16 terabytes for data and creating new forms of operating system-controlled CPU memory, such as hyperspace, IBM has created room for radically improved relational database performance.



"ESA positions us for very huge processor storage," Gary Ferdinand, DB2 product manager, noted. As an increase is realised in both real memory and expanded storage — the internal memory reservoir under the control of the operating system's paging supervisor — "DB2 can use just about every byte you can throw at it," Ferdinand added.

Thus, IBM appears to have taken a giant step in the direction of satisfying what, until now, has been an academic wish that unlimited memory inside the processor be put at the disposal of a relational database management system.

Such a move will not free a mainframe user from all constraints. On the contrary, it raises new problems as well as possibilities.

Trying to manage the data of large databases when it is frequently in motion between disk and DB2 buffers raises new exposures. Trying to update a database of several million records while operating in realtime creates new risks.

In addition, ESA and the 3090E processors represent the most expensive products in IBM's stable. Customers would be well advised to look not only at how much they can do with DB2 but also at the price per transaction.

Nevertheless, IBM has succeeded in pushing back the limits of relational DBMS operation on several fronts at once. It appears the door will be open one day to the use of DB2 for multiprocessing work.

IBM can work on tying each processor in a multiprocessor machine to a separate DB2 buffer and multiply transaction throughput accordingly.

There is a second shoe that will drop before the ESA saga fully unfolds and that is the IBM repository. An application development system based on an introductory IBM repository, it could offer tools to speed the development of DB2 applications.

With the ease-of-development capabilities already offered by relational systems — the programmer does not have to define where the data is — a repository and DB2 combination could begin to attack the application backlog at some of IBM's largest customers.

A high rolling DB2 is good for IBM, of course. But the database management system market remains incredibly competitive. Third party vendors make much of the speed of their products and fight for a slice of the action.

It is that market and IBM's attitudes to its stable of database management systems that form the core of this issue of *IBM World*. Its articles address subjects such as IBM's attitudes to some of its own offerings, as well as to some third party products like Pick, and a comprehensive overview of the significant trend to online transaction processing systems.

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A window of opportunity

When IBM crashed through the $A1000 million mark last year it was an indication that the Australian industry as a whole had reached a new maturity, Len Rust explains.

• *Len Rust is vice-president, Asia/Pacific, for International Data Corporation.*

A decade ago, IBM Corporation's worldwide revenue was $US21 billion while its Australian turnover was a mere $195 million. These figures are trifling when compared with the $US54 billion and $1.1 billion IBM generated last year from its worldwide and Australian operations, respectively.

The year 1978 was also one in which IBM introduced the System/38 — a powerful midrange processor then but a baby when compared with its latest successor, the AS/400, which was announced recently.

In isolation, these examples are merely stopping points along a graph charting the course of the computer industry. Taken in context, they indicate just how much has changed in a scant 10-year period in an industry which, even now, is less than four decades old.

By nature, the information processing industry is evolutionary rather than revolutionary although so many products emerge and so many technologies have such impact that it is sometimes hard to believe that they have not sprung from nowhere. Just as 60 or 70 years ago the car was something of a novelty, 10 years ago it was hard to envision the profound impact computers have had, and will continue to have on our lives.

In 1978, batch processing was still one of the key tasks handled by computers and bureaus were kings. Although we were well past the white-smocked technician and valve days, computing was still a specialist job and a mystery to many people.

In fact, in those days, computers were still computers. They had their own air-conditioned environments and were tended by data processing staff who spoke a language foreign to the rest of the world. Today, we find it hard to imagine what life would be like without a PC or a terminal permanently in place on our desks.

This has been made possible by a trend which IDC refers to as downsizing. As smaller systems increasingly deliver performances comparable to large systems, at much lower price points, more and more users have access to the computing power they need. Downsizing has been occuring for several years and will continue to do so. It is particularly important in the Asia/Pacific region because the lower entry price will allow a quicker harnessing of the computing capabilities required.

There is no doubt that the visibility of computers will continue to increase in Australia and the rest of the Asia/Pacific region over the coming years.

Communications are vital

Communications will also play a greater role in our business and personal lives. A decade ago, it was a difficult task to get two similar computers, standing side by side, to communicate. Now, with the advent of communications standards and modems, we think nothing of dialling from one computer to another hundreds or even thousands of miles away.

Communications will be the watchword as we go into the 1990s. Many countries in the region are still relatively underdeveloped but today's communications technologies, primarily fibre optics and satellite, will open up vast new territories and opportunities in the Asia/Pacific region. Australia, already riding a communications boom, will continue to find ways to exploit these powerful technologies.

Australia's vast geographic area has led to the development of considerable communications expertise in this country, both in wide area and local area networking. This opens up a wide array of opportunities for local suppliers to market these services and technologies across the Asia/Pacific region.

However, Australia must be careful to avoid missing the window of opportunity which is never open for long and will be targeted by suppliers from a number of other technologically-developed countries. Australia does have the potential to be a serious world competitor in a number of areas such as artificial intelligence and computer-aided software engineering (Case), both of which will play significant roles in business development.

Other technologies which will come to bear over the next couple of years include supercomputers — again we are seeing a certain amount of downsizing in this segment with the arrival of the minisupercomputers and image processing.

As growth slows in established markets it will be these new technologies which fuel the continued increase in the information processing industry. Similarly, while opportunities may disappear within Australia, new ones will present themselves in other countries in the region, throwing down a whole new set of challenges for the "informaniacs" to overcome.

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Purchasing pitfalls

The road to the benefits of computer-aided manufacture is never smooth, but companies like Selleys (see page 8) have persevered to reap the benefits. Malcolm Wray gives a guide for System/38 users

WHEN choosing computer manufacturing systems to optimise their business operations for the next decade, wise selection teams will focus on company needs and requirements, rather than the vendor's list of functions. In doing so, they may be able to avoid some of the many pitfalls that await prospective system purchasers, and ensure they make their major investment wisely.

It helps enormously to be aware of some of the tactics which can be adopted to avoid the worst consequences of these pitfalls.

For example, because few companies go through the process of selecting a large-scale computer system more than once every five years or so, relatively few selection team members are going to be experienced. This simple fact creates one of the most fundamental imbalances in business — when the amateur selection committee pits its wits against the real professionals whose interest is in selling their company's computer solution.

With such an unequal lineup being so commonplace during the selection process, it is small wonder that many companies still end up with inappropriate or unsuitable computer solutions which can sometimes cost many thousands of dollars more than anticipated to deliver.

Inexperience can be turned into less of a disadvantage when buyers avoid relying on a Request for Proposal (RFP) that is based too heavily on generalised checklists. After all, any realist must recognise that there are few software vendors prepared volunatarily to eliminate themselves by saying "no" to functionality issues. Indeed, most vendors can be relied upon to deliver only such information as will ensure they remain in the final bidding process.

Buyers must therefore always bear in mind that the object of the exercise is to buy the best solution for their particular company — there is no such thing as the "best computer solution", only ones most likely to address their particular requirements.

The IBM System/38 minicomputer has been around for years, and still functions well — but the proper software is essential if the system is to perform to a particular company's demands.

Manufacturing and distribution software packages have attained fairly high levels of general functionality over recent years. But many specific industries still have special needs not necessarily addressed by generalised systems. It is therefore essential that buyers allow the time and develop the sophistication to ensure the system they are evaluating is entirely appropriate to their requirements.

Again, the IBM marketplace is flooded with products designed to make software development faster and less expensive. These include a host of application generators, fourth generation languages (4GLs) and Computer Aided Software Engineering (Case) tools. But some of those tools are going to be far more appropriate to the needs of one particular company than are others.

It is essential to know before you buy whether any system is truly appropriate to your company's needs. It is also essential to recognise in which cases application development is best performed inhouse, and where it is more appropriate to go to an outside vendor's solution.

But no system is flexible enough to meet every need; it is therefore essential to avoid generalised checklists in favor of a list developed specifically to address the requirements of the buyer company. The checklist must cover the company requirements and be matched to the business, its growth, its industry and its strengths and weaknesses.

Today's large integrated systems on the System/38 are highly complex at both the code and process levels. Experience has demonstrated time and again that major changes made during the implementation of a system greatly multiply the risk that the system will fail.

Malcolm Wray is manager of manufacturing for Pansophic Systems Australasia.

Yet one still hears of manufacturers purchasing packages then spending the equivalent of many man-years to tailor them to their requirements — an expensive and time consuming way to realise their mistakes.

Excessive development work can be avoided by taking time and trouble in the selection process. It must appear feasible that the software under evaluation is able to address such typical (and reasonable) goals as:

- Obtain between a 75 per cent and 100 per cent return on investment in the software system;
- Keep all operating costs within budget;
- Develop production schedules able to meet commitments;
- Co-ordinate purchases with production schedules to keep inventory to a minimum;
- Provide for exception reporting and reduced clerical work; and produce timely budget reporting to meet changing demands.

Strengths

In addition, take the trouble to know the software vendor thoroughly. Select vendors with a reputation for strength, stability and high levels of support. In knowing the company you stand to gain a better indication of the current state and future direction of the products they sell. Above all, recognise that vendors may have strengths in particular vertical market areas, while remaining weak in others.

By keeping the following procedures and definitions in mind during the selection process, most companies should be able to avoid many of the possible pitfalls:

1. Pick systems requiring as few changes as possible to fit your business. Most failures in implementation occur because of major changes made to the package to tailor it to special or particular requirements.
2. Take care to determine the financial stability of the vendor in the interest of the long-term growth of your system.
3. Select a vendor whose products revolve around a limited number of machine or architecture product lines. Such vendors can give dedicated attention to increasing the functionality of their products.
4. Ensure appropriate implementation support will be available as it is needed, including project monitoring support.
5. Check vendor references, and develop your own list wherever possible. Ask sites about the quality of customer service, documentation, training and hot line support.
6. Evaluate the vendor's future plans, including the planned functionality of future version of particular products. Check these plans against the vendor's past performance.

By observing such general principles, and ignoring generalised checklists you can ensure that your implementation is successful.

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Tuning the handyman market

Selleys has spent four years pruning inefficiencies from its manufacturing system, with good results

■ *Expert advice led Selleys' to pick BPCS, a sophisticated package*

ONE of Australia's largest suppliers to the home handyman market, Selleys Chemical Company Pty Ltd, has spent the last four years pruning inefficiencies and inadequacies in its manufacturing system. In that time its turnover has risen from $A37 milllion to $A53 million; stock accuracy has jumped from 85 per cent to 97.6 per cent; and the company has seen a factor productivity gain of more than 30 per cent.

The company's growth has not just been the result of increased demand for its products; it is also because Selleys has implemented a streamlined computer system which has given the company's management better tools for decision-making.

Using a sophisticated manufacturing, distribution and financial software package called BPCS (pronounced Bee-Pics), Selleys is building a fully integrated, centralised system.

The software keeps track of 450 product lines, branch offices in every State and the distribution of goods throughout 8000 wholesale and retail outlets. In addition, BPCS handles the distribution for products which are exported to more than 12 Asian and Pacific countries.

DP manager for Selleys, Joe Vurchio, said automating a factory and streamlining distribution was not an easy task — particularly when you set yourself a six-month implementation deadline.

"We decided the installation should be user-driven. The users were educated as to how the overall manufacturing operations would work, which meant they were very much involved in implementing the system themselves," he said.

Selleys hired a manufacturing consultancy to help select the hardware and software. It formed a project management team, taking the best people out of each area to work on the project. A master plan was developed along the Manufacturing Resources Planning II (MRP II) guidelines set down by the manufacturing guru, Oliver Wight.

Final choice

Planning and selecting a system took 12 months. The final choice was BPCS software from SAA Services Pty Ltd. The hardware choice was an IBM System/36, which was recently upgraded to an IBM System/38.

Vurchio said that BPCS was a 90 per cent fit. "The next closest fit was 80 per cent. We chose IBM because BPCS runs on it."

BPCS is a fully integrated manufacturing, distribution, financial, process industry and decision support package. Selleys purchased the full suite of manufacturing, MRP, capacity planning, purchasing, shop floor control, master production schedule and costing modules.

The total investment in computer hardware and software is about $A1.5 million. The time and commitment is far greater, and, Vurchio said, not without some pain and the development of some stringent rules.

"We had to lay down strict rules for the project to work. For example, each member of the project team was assigned to detail a set of responsiblities, estimate the time it would take to implement each phase of the new computer system, then action each item by the set deadline."

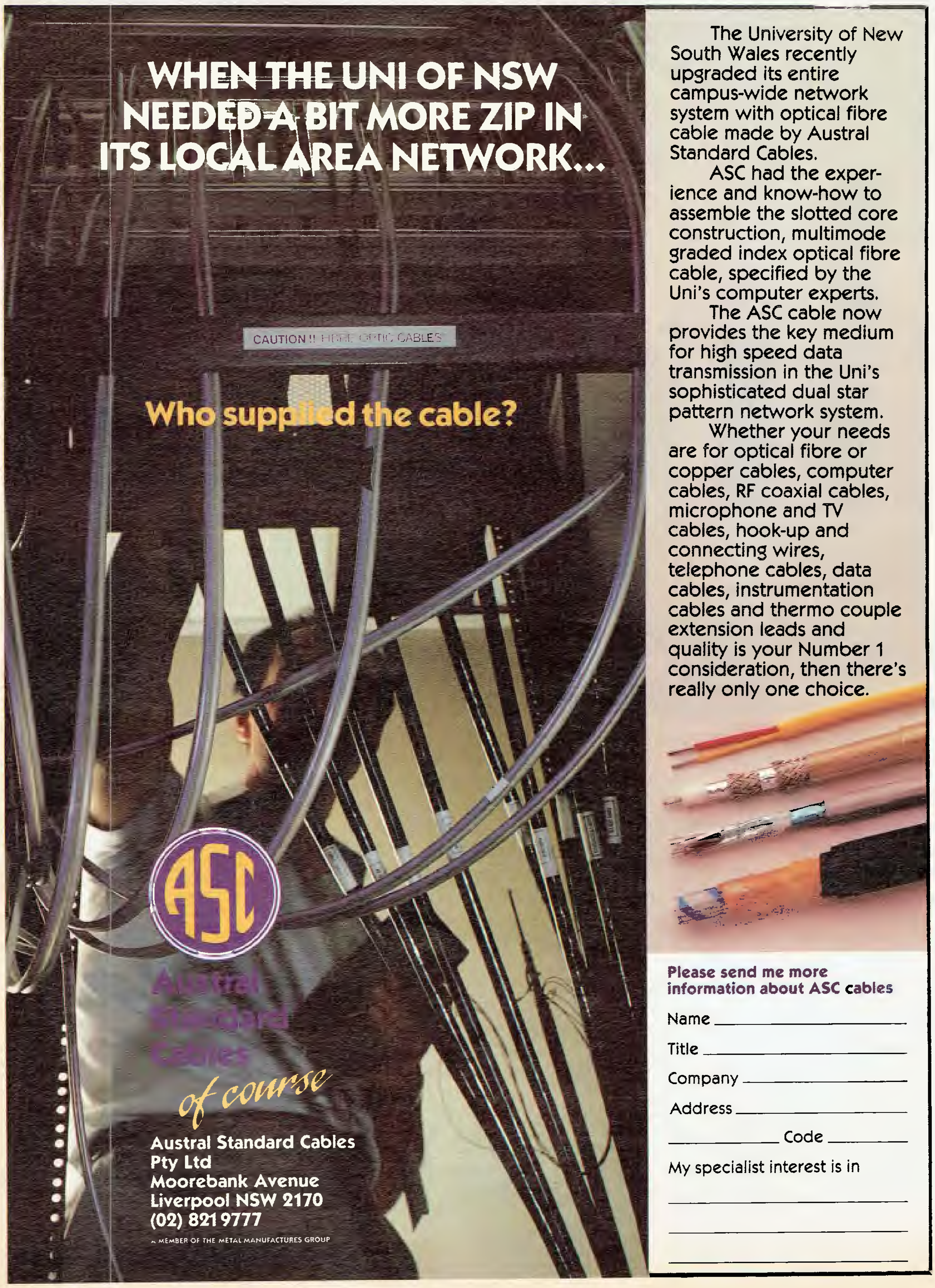
Vurchio said users were encouraged to attend various educational courses by SSA, Oliver Wight and Apics (Australian Production Inventory Control Society).

Inevitably, since the BPCS/IBM decision, some of the staff's daily tasks have changed. In some areas major changes were needed throughout Selleys.

"Our shop floor control was almost non-existent and production supervisors had been selecting their own material from the stores," Vurchio said.

"This meant that machine set-ups were often wasted due to material shortages. It also contributed to our bill of material and inventory level accuracy being below 90

(Continued page 10)



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Tuning the handyman market

(Continued from page 8)

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■ *Selleys' DP manager Joe Vurchio (right) and inventory manager Darrel Fitzpatrick*

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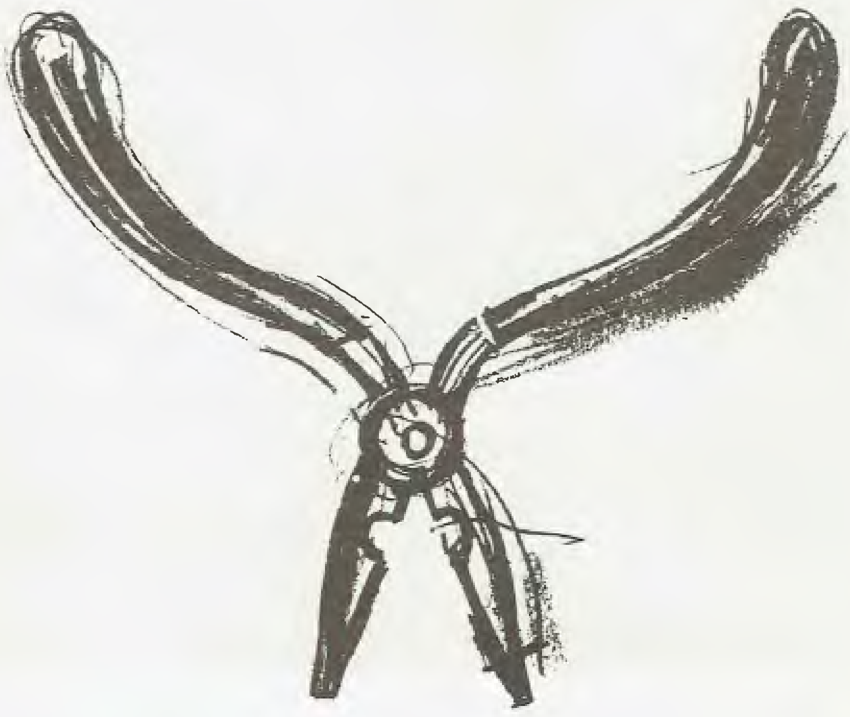

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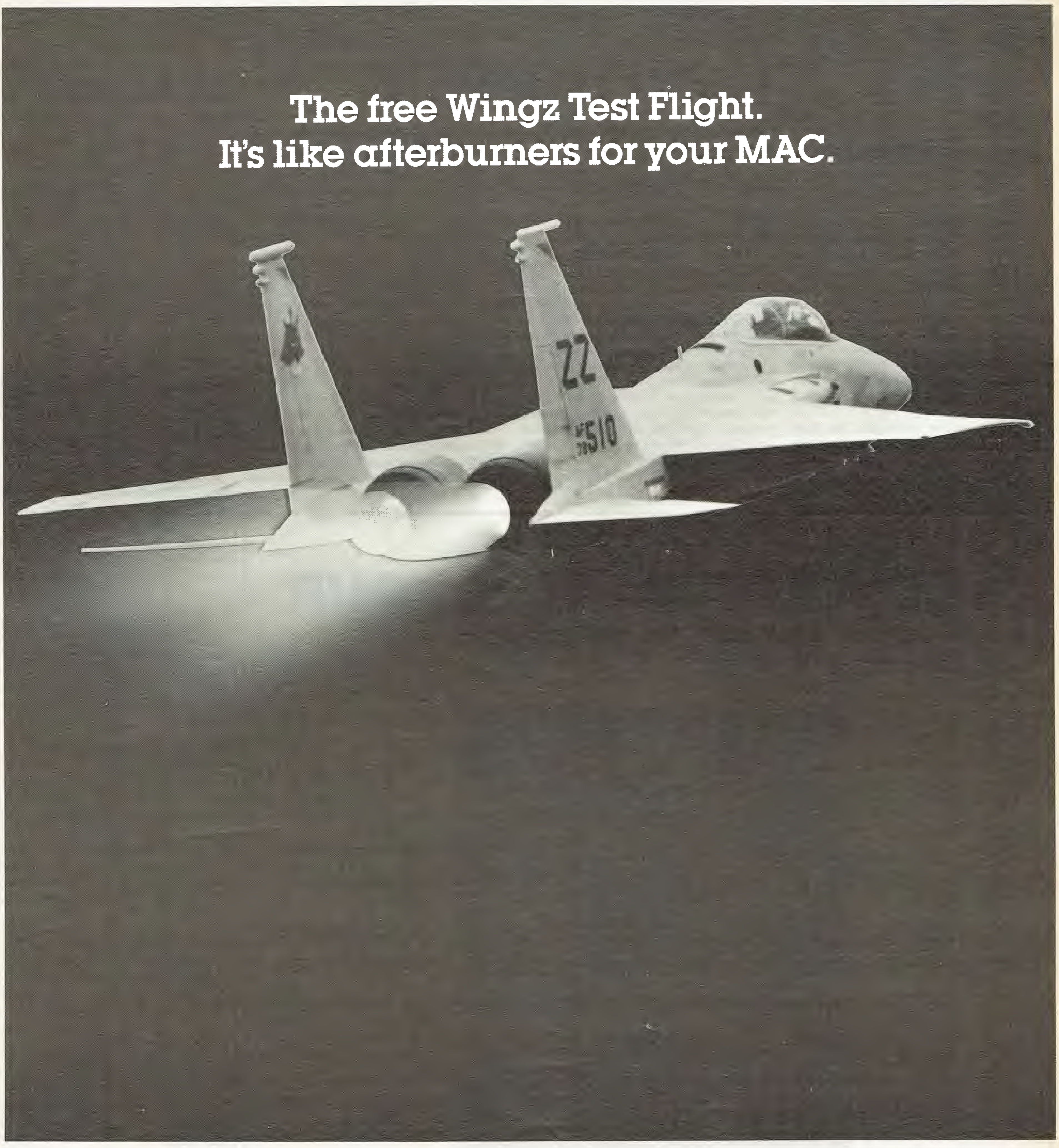
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Tests to exonerate NetView

IBM's own benchmarks counter the claim that management system is hungry for precious CPU cycles, says John Cox

IBM recently released test results showing that the latest version of its NetView network management system outperforms the earlier version by 30 per cent to 50 per cent without adding significantly to the host resources required. The company will apparently use the benchmark results in an attempt to counter a perception that NetView saps precious CPU cycles.

NetView, first released in May 1986, combined several existing separate host-based network managment products and features for centrally managing multiple or interconnected Systems Network Architecture nets.

Communications managers use NetView for, among other things, tracking and controlling terminal usage, identifying and reporting on hardware problems, testing modems and collecting data on specific network resources.

Results of the IBM study, "NetView—Vtam Benchmark Study Results" (IBM publication SC30-3489-0) can be used by network managers as a guideline to identify possible performance problems with NetView and to study the impact of upgrading from Release 1 to Release 2.

According to IBM officials, the results of the study showed that the company achieved its goal of offering a network management product that maintained a consistent level of CPU consumption regardless of the size of the customer's network.

NetView was tested on a mainframe system to determine CPU requirements and on a departmental system to compare the two NetView releases.

The mainframe system was made up of two interconnected 3090-200 computers: one a Communications Management Configuration (CMC) simulating control of a varying number of terminals (5000 to 65,000); and the other, an application host. Both systems used to MVS/XA operating system.

With different numbers of terminals, the CPU test measured six Vtam processes: network activation and de-activation; logon and logoff; node failure and a send/receive mode — sometimes called steady state. Each process was tested once with Vtam only and a second time with Vtam and NetView.

Network activation, measured in CPU seconds (the length of time the CPU has to run to execute instructions for a particular process), took only slightly longer with NetView than with Vtam alone.

"It does not cost much more (in CPU resources) to Vtam to use NetView," said Karen Meneitto, staff programmer with IBM's Network Management Product Development group, which ran the tests. Similar results were found in the other Vtam processes.

The steady state test — mimicking activities such as logons, logoffs, and sending and receiving data from terminals in the network — measured NetView's CPU utilisation of both hosts.

The test showed that with 5000 terminal sessions, NetView used just under 5 per cent of the CPU resources on the CMC host. Host utilisation rose to just under 20 per cent for 30,000 sessions.

The application host CPU utilisation reached about 4 per cent at 10,000 sessions and stayed there because the application was "running as fast as possible", said Jerry Kaplan, IBM manager of NetView performance and usability.

"As network size increased, the performance (of NetView) increased dramatically because Release 2 exhibited linear performance growth," he said. That meant the share of CPU resources used by NetView grew proportionately as network size increased.

Rough guideline

The steady state results provided a rough guideline for network managers to check NetView performance in their installations, Kaplan said. "If they find NetView is swallowing 40 per cent of the CPU, instead of just over 10 per cent, with 15,000 sessions as the benchmark tests record, it may indicate a configuration problem of some kind," Kaplan explained.

The smaller test, comparing NetView Release 1 and 2, was run on a departmental 9370 Model 60, using the VM/SP operating system and Vtam. Repeating the same Vtam processes, the testers found that Release 2 outperformed Release 1 by 30 per cent to 50 per cent, according to Thad Jennings, the senior associate programmer who managed the 9370 tests.

The steady state tests, which mimicked the typical workload of a program development operation, showed an improvement of more than 30 per cent for each network size tested.

For Release 1, the ratio of NetView CPU utilisation to total system CPU utilisation was about 11 per cent, compared with 7 per cent for Release 2, IBM reported.

The IBM officials warned that the test results reflected averages and that NetView CPU consumption soared at some points, reflecting shifts in the workload and other network activity.

"The Release 2 performance improvements are both expected and welcomed by users," said Jeremy Frank, program director for enterprise network strategies at the Gartner Group market research company.

According to Frank, there has been a perception that Release 1 did not perform well. But Donald Czubek, president of Gen2 Ventures, a market research group specialising in IBM communications, disagrees: "Among the users I have worked with, NetView performance has not been a major issue," he said.

The new IBM benchmark study is available from IBM branch offices, along with an earlier companion study, "Network Management Performance in a Communications Management Configuration (CMC) Environment" (GG 66-0285).

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NT police find 3090 a boon

The progressive Northern Territory Police Department has implemented a computer-aided despatch system with outstanding results. The system, the first of its kind to be used by an Australian police force, has cut paperwork, provided a statistical base for planning and reduced response time for NT police operations.

Developed by the department in conjunction with Ncom, the Northern Territory government's division of computing and technology, the system is based on the government's central mainframe, an IBM 3090.

The police operator taking a telephoned complaint keys in the details on a preformatted screen.

Through the computer system, the information appears on the despatcher's screen, which shows all tasks awaiting action and locations of all vehicles. Jobs are automatically coded into categories (which can be overridden by the despatcher).

The despatcher selects a vehicle and radios the car. The crew's response, and later, its report of a completed job, are entered on to a report panel. The crew can enlarge on this when it comes off the shift, but the information is all contained in one area and accessed via one of the muster room terminals, cutting out extensive paperwork.

The right car

Computerising all records relating to an incident allows shifts to be planned more effectively, and the right car to be directed to a job at the right time. Since the system was introduced in July 1985 response time for category one, high priority tasks, has been reduced from 14 to seven minutes.

But increased effectiveness in day-to-day operations is not the most far-reaching effect of the introduction of the system which, according to the man in charge of its development, Superintendent Bill Wilson, has "succeeded beyond our wildest dreams".

"We needed a better statistical base to allow us to see if our resources were being used to best effect. The information was there, but in manual form and not readily utilised.

"The computer aided despatch system is allowing us to orchestrate our whole operation, to use our resources to best effect."

At the end of every eight-hour shift the system supplies the number of jobs by category and by sectors of Darwin. At the end of every 24-hour period a full report is available showing response time for each job, how long each vehicle spent at each job, and average response time.

Planners can bring up all the complaints relating to one address, for example, or can look at statistics for particular streets, districts or categories of job, giving an unprecedented advantage in resource allocation and forward planning.

The system operates off the NT government mainframe, which supports the entire Northern Territory communications and information network. This allows interfaces with other databases. For example, a police officer on patrol is able to determine, before he approaches a vehicle which has attracted suspicion, whether or not it is stolen.

Side benefits of the computer system include an instantly accessible record of all street names, businesses, owners and keyholders, plus all police telephone extensions for direct dialling.

In Australia, only in the Northern Territory do police crews have realtime, online access to vehicle registry information such as vehicle owners and registration details, correct to the second. Most police forces operate on tapes updated overnight, or even weekly.

Crime reports are currently being computerised for integration with the despatch system, and a pilot project is marrying the despatch database with the NT government's Mapnet land information system.

The government operates one of the most advanced government computer networking systems in Australia, which has helped its police department become one of Australia's major police users of computer systems.

■ *Superintendent Wilson and IBM's Paul Cosgrave watch operations in the NT police despatch centre*

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Fujitsu meets AS/400 threat

Peter Scott examines Fujitsu's response to the challenge of IBM's AS/400 competition

■ *Neville Roach . . . sees no impediment*

WHEN IBM released its AS/400 many users of the hugely popular midrange System/36 and System/38 machines breathed a sigh of relief. The AS/400 promised them a future compatible with their existing systems.

In fact, the AS/400 opened the way to a whole new future of midrange computing in the IBM environment, incorporating as it did the concepts of Systems Application Architecture (SAA).

But if IBM's users were ecstatic, other manufacturers in the field were not totally convinced that the AS/400 posed a great threat. Fujitsu has been a strong competitor in IBM mainframe environments for many years, but its entry into the midrange arena is more recent. Neville Roach, general manager of marketing for Fujitsu Australia, believes his company's limited experience in the field is no impediment to its success — the AS/400 notwithstanding.

"IBM has a large installed midrange base which is the target of the AS/400 announcements," he claimed. "Fujitsu has a range of products that will more than hold their own and we believe we will be able to win a good share of the market."

Fujitsu's efforts to win new midrange business concentrate on the company's ability to offer more than a single option for customers.

"First we have the traditional M-Series machines with standard mainframe architecture and the ESP III operating system. This operating system is advanced and user friendly. It has facilities that IBM is only now beginning to address with the AS/400," Roach said.

"A second option is the computer industry standard approach through Unix. The Unix world is very powerful, and the growing move to standards is very strong. Fujitsu offers a range of products that starts at less than $A50,000 and goes up to supercomputers. The main product in the Unix midrange is our A series.

"The third option is through the Pick operating system, which has a very strong presence in Australia. Pick offers a range of applications that would rival anything the AS/400 has to offer. Fujitsu's S2000 series machines are based on Motorola microprocessors. They have just been released here, but we have already taken our first order. We also have the installed base of Wicat," Roach added.

The Pick machines are sourced from Fujitsu's US subsidiary, which has been involved with the independent operating environment for some time. Although they are relatively recent arrivals on this market, Fujitsu has an Australian team devoted to development work. "This team includes three R&D people who were responsible for porting Pick to the Wicat hardware," Roach noted. "We are working closely with our counterparts in the US to share the R&D responsibilities."

> ‘A range of products that will more than hold their own and win a good share of the market’

While IBM justifiably highlights the database management system that is integrated with the AS/400, Roach believes Fujitsu is able to offer equivalent systems with all hardware options. The Pick systems, of course, have the relational database integrated with the operating environment. There are many highly regarded third party options for use with the Unix operating system, and for the M-Series under ESP the company offers its own relational database management system.

While Fujitsu is confident it has an array of hardware to counter the AS/400, it is adopting a wait and see approach towards IBM's SAA master plan.

"SAA is still a concept," Roach said. "Our objective remains to offer compatibility, therefore we will look to see how SAA develops. We will wait and see which features the users want, and when their needs become clear we will meet them."

Despite his conviction that Fujitsu can match the AS/400 in all respects, Roach admits that it signals a clear trend in computing towards enduser friendliness.

"We are looking at computing in an office environment without the need for a trained operator. We are selling solutions to non-professional DP people. We have to sell a total package to take account of the operatorless environment," he acknowledged.

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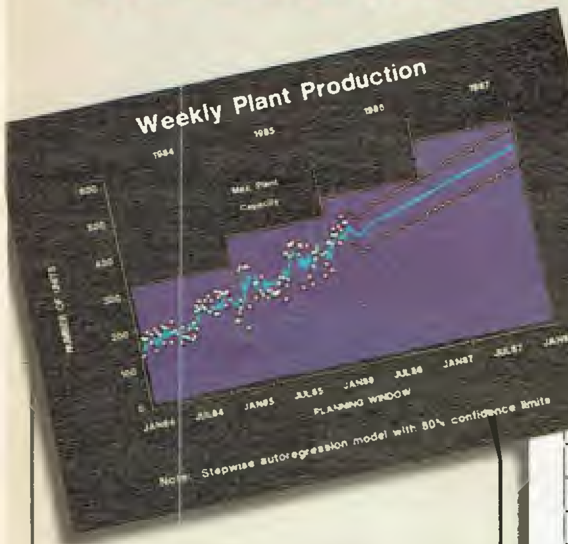

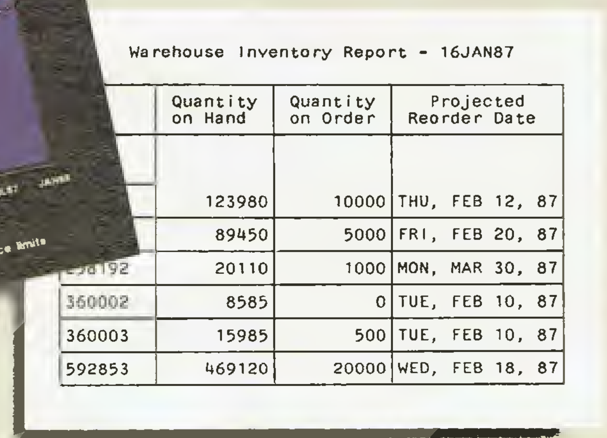

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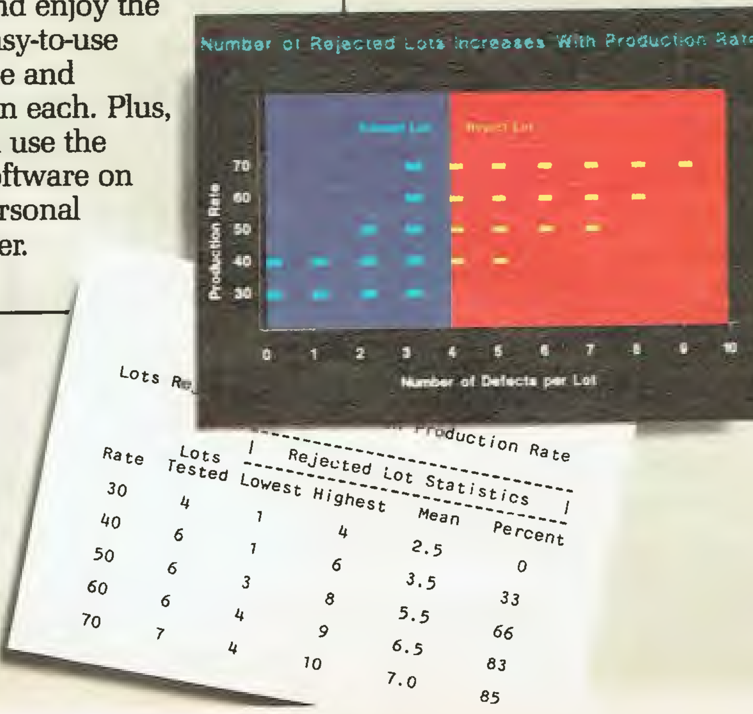

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* Computer Intelligence, January 1986.

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IBM & DATABASES

DB2 began it all

Its impact dramatically altered the shape of competition, and relative growth of product market segments, says Scott McLarnon

THE transition in the mainframe database management system (DBMS) and application tools market began with the introduction of IBM's DB2.

Although DB2 shipments were limited until 1986, the product has had a profound impact on the mainframe and departmental DBMS markets that goes beyond its 10 per cent share of installed mainframe DBMSs.

DB2's direct and indirect impact dramatically altered the shape of competition and the relative growth of the different product-market segments within IDC's application tools market.

To review briefly:

- The introduction of DB2 extended the sales cycle and delayed acquisition of independent software vendor DBMSs during 1985-86. In 1986-88, IBM DB2, SQL/DS and IMS captured 50 per cent of the mainframe DBMS licence shipments,
- IBM's aggressive marketing of DB2 legitimised the relational DBMS model, opening the door for new competitors (Oracle, RTI) to challenge the old.

Compounding the problems of the incumbent independent mainframe DBMS (ADR, CCA, Cincom, Cullinet, and Software AG) was the corresponding slowdown in mainframe system shipments which peaked in 1984 and later declined, leaving the independents with a smaller piece of a smaller pie.

With the mainframe installed base effectively saturated, limiting mainframe shipment growth, IBM successfully pushing DB2 (and SQL/DS), and aggressive new DBMS competition from Oracle and RTI, new mainframe DBMS licence revenues for the established players lagged. In order to grow (and for some, simply to survive), all of the independent were forced to rethink their strategies and to make significant shifts in their business mixes.

Vendor response

This strategic review and change in vendor directions set in motion a complex, interrelated set of market forces which IDC has attempted to model in developing the application tools market forecast.

IDC believes the following market forces will have the greatest impact on the DBMS/application tools market for the 1988-1992 forecast period (see box).

Some of these vendor initiatives are supported by strong MIS interest and will likely result in major market movements.

For example, downsizing application development platforms — from the mainframe to the workstation — will be one of the most powerful forces shaping the application tools product market.

In contrast, the movement to distributed database management systems (D-DBMS) will lag because of delayed vendor initiatives and the implementation problems that MIS are likely to encounter with the new D-DBMS products when commercially available.

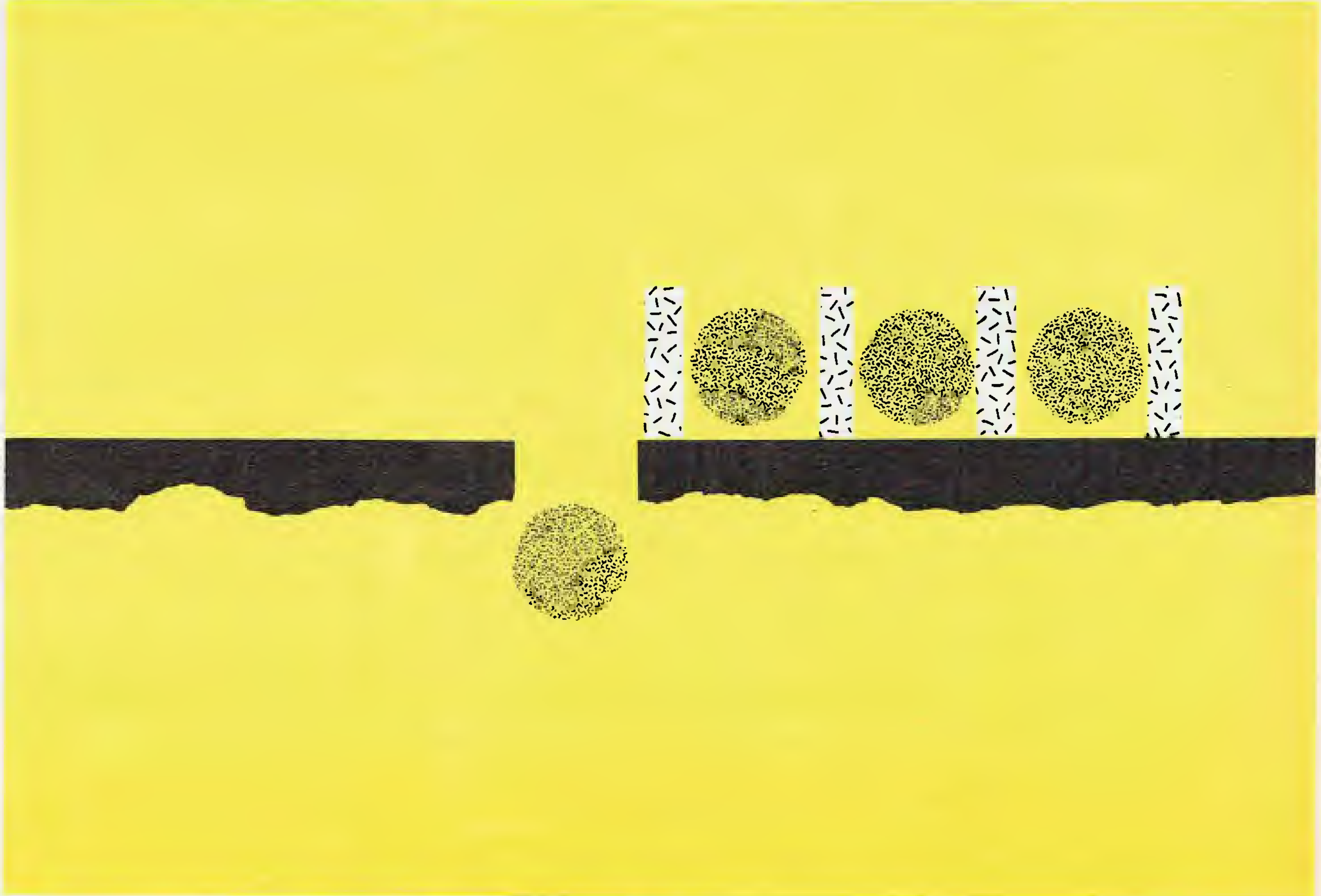
The independent vendors have not delivered an SAL-based, relational D-DBMS product that transparently integrates multivendor environments. Moreover, IBM does not have a strong presence in the departmental processing market. As a result, IBM is pushing a two-tiered architecture into larger accounts (backend mainframes for DBMS and application processing and frontend PS/2 to handle the user interface).

With no IBM push, and with limited application and database-level integration across multiple vendor environments, it is unlikely that D-DBMS will take off in the near term.

To varying degrees, each of the independent vendors has been impacted by these market forces. All ISVs have made (or will make) these transitions to a certain extent.

The downsizing of application development and maintenance is driving profound change within the application tools market. The change is most profound because there is a strong impetus on both the supply side and the demand side of the market equation to shift application development business from the mainframe

(Continued page 16)



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DB2 began the market transition

DBMS/Application Tools Market Forces:

New mainframe DBMS license revenues ▷ Mainframe DBMS maintenance revenues
DB engines ▷ Add-on tools
Mainframe DBMS/tools ▷ Departmental DBMS/tools, workstation tools
DBMS/tools ▷ Application solutions
Software ▷ Services
Proprietary tools ▷ Open architecture tools
Direct sales ▷ Application VARs
Single-vendor ▷ Multivendor environments
DBMS/application tools ▷ Other MIS data center & tools (network management)
Fragmented ▷ Consolidation
Proprietary architectures/implementations ▷ Standards (SQL, SAA)
Go it alone ▷ Strategic alliances
Narrow product lines ▷ Broader product lines
Customer base ▷ Prospects
Mainframe orientation ▷ Distributed
Private ownership ▷ Publicly traded
Departmental ▷ LAN servers
R-DBMS in information center ▷ R-DBMS for production applications

(Continued from page 15)

on to departmental and personal computers.

The supply-side (vendor) motivation is to escape the slow-growth mainframe market and competitive pressure of DB2. To illustrate, Cullinet acquired several companies to commercialise IDMS/SQL and Knowledge-Build, its recently released DBMS and application tools for the DEC Vax environment. This is a major component of its 3 x 3 product strategy. Other DBMS and tools vendors have pursued similar strategies.

The demand-side motivation from MIS is to offload application development from the mainframe to departmental processors and personal computers. Pure economics drives much of this migration. MIS sees the price performance of smaller processors and powerful workstations making better economic sense than tying up expensive mainframe Mips on application development activites that are effectively handled by smaller processors.

The downsizing of application development is likely to be more dramatic than the downsizing of application processing or database management. IDC expects much application development activity to move from the mainframe directly to the workstation, largely bypassing the departmental computer.

While application development is likely to move to the workstation, the run-time environment will be on a mainframe or departmental computer.

The movement from captive proprietary tools (for example, Cullinet's ADS/O currently runs only with IDMS/R) to open architecture tools (Cincom Mantis runs on Supra, as well as DB2 and other DBMS environments) will increase as customers refuse to get locked into any one DBMS architecture. Customers will look for application development environments that create portable and co-operative applictions that can execute on a variety of hardware platforms, operating system and DBMS environments.

Old-line DBMS vendors must make a major cultural adjustment to move from captive proprietary tools to portable, open architecture tools. The major concern is that supporting DB2 or other DBMSs will accelerate movement away from that vendor's DBMS.

While this is a legitimate concern, in the long run it is generally better to cannibalise your own products and retain your presence within the account than to let a competitor take the business. Moreover, an argument can be made that by opening the application development environment to support other DBMSs, that vendor becomes more strategic within that particular account.

Vendor positioning

As the mainframe DBMS market has matured, the independent vendors' revenues have shifted from new licences to maintenance. The net effect of this change in revenue mix has been to understate the magnitude of the competitive shifts in the DBMS and application tools market.

Cullinet has seen maintenance increase in relative importance within the DBMS/Application Tools product-market segment. IDC estimates that maintenance represented 70 per cent of Cullinet's application tool revenues in 1987. Moreover, the new licence revenue mix reflected a shift from the IDMS/R DB engine to add-on tools, including ADS/O (a mainframe-based 4GL) and IDMS/Architect (a PC-based Case tool). Look for this revenue pattern to intensify for Cullinet's mainframe business in 1988-89 as IDMS/R sales slow further.

These transitional market forces are shaping the DBMS and application tools market for 1988 and will continue to define the basis for competition in the future.

■ Application development tools (4GLs, Case), not the DB engine, will be the major source of revenues.

■ DB2, while showing the mainframe DBMS product-market segment in 1988-89 as ISVs develop and market DB2 application development tools. The proliferation of DB2 applications and tools (IBM claims that there are 100 + ISVs currently developing tools and applications for DB2) will reinforce DB2's momentum.

The short-term and long-term performance of the major independents will depend on how well-positioned they are to take advantage of these market trends.

● *Scott McLarnon is an analyst with International Data Corporation.*

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Australians boost the AS/400's data potential

Roger Clarke reports on DBMS improvements made possible by a new development and maintenance tool.

● *Roger Clarke spent 17 years in private industry in Sydney, London and Zurich, specialising in application software technology and its management. He took up the Readership in Information Systems at the Australian National University in 1984.*

IN THE midrange, especially now, and especially in Australia, IBM faces very strong competition. Medium-sized user organisations are price-conscious, and increasingly wise in the ways of computers. The aura of safety and dependability is less crucial than in the mainframe market ("no-one ever got the sack for buying IBM" means little to an owner-manager!).

So, in the midrange, what sells computers is mainly the right applications and the initial cost, and secondarily the life-cycle cost of ownership and technical effectiveness. So IBM has to get in there and kick, scratch and bite with the rest.

The System/38, and its successor, the AS/400, have in their integral relational database management system, a particularly strong feature. What IBM must clearly do is build upon the good start its integral DBMS has given it, and keep ahead of the competition. But the AS/400's database management facilities do not offer a significant improvement on those of the S/38. This article discuss the way in which an Australian company is showing IBM how to capitalise on a market advantage.

The essential differences that the AS/400's DBMS offers are a snug fit into the Operating System, and a fairly efficient implementation of relational features. It has a language for defining data, called DDS, which enables disk-storage, and screen and printer formats to be defined and compiled. User views can be defined, to simplify data access.

> ‘ Grasped an opportunity missed by IBM ’

Indexes can be easily created, to enable data access via "secondary" and foreign keys. Since relational data schemes map fairly efficiently down on to disk-files, it is generally feasible to create the physical model directly from the logical model, without compromising it.

The AS/400's major development language is an odd one, RPG. But the modern RPG III is powerful, and a distant echo of its ancestors. (Indeed, most contemporary programmers are probably unaware that the original Report Program generator had a fixed processing cycle embedded in it.)

But is the S/38 data management environment of the mid-1980s enough? The transaction processing systems, MIS and decision support systems demanded by today's organisations must be powerful and highly integrated.

Aggressive companies in many industries are using inter-organisational links and Electronic Document Interchange (EDI) to provide their strategic and competitive advantages. To underpin these developments, DBMS must offer far more than mere physical data management, and more than logical management. They must lay the foundation for efficient and reliable development of complex applications, and for efficient and reliable maintenance of those valuable investments.

Lamda is a full-function application development and maintenance product, produced by the Australian company, Aspect Computing, and marketed both domestically and overseas. It incorporates a high-level ("4GL") language with online debug facilities, an application generator, screen and report painters, and data definition modules.

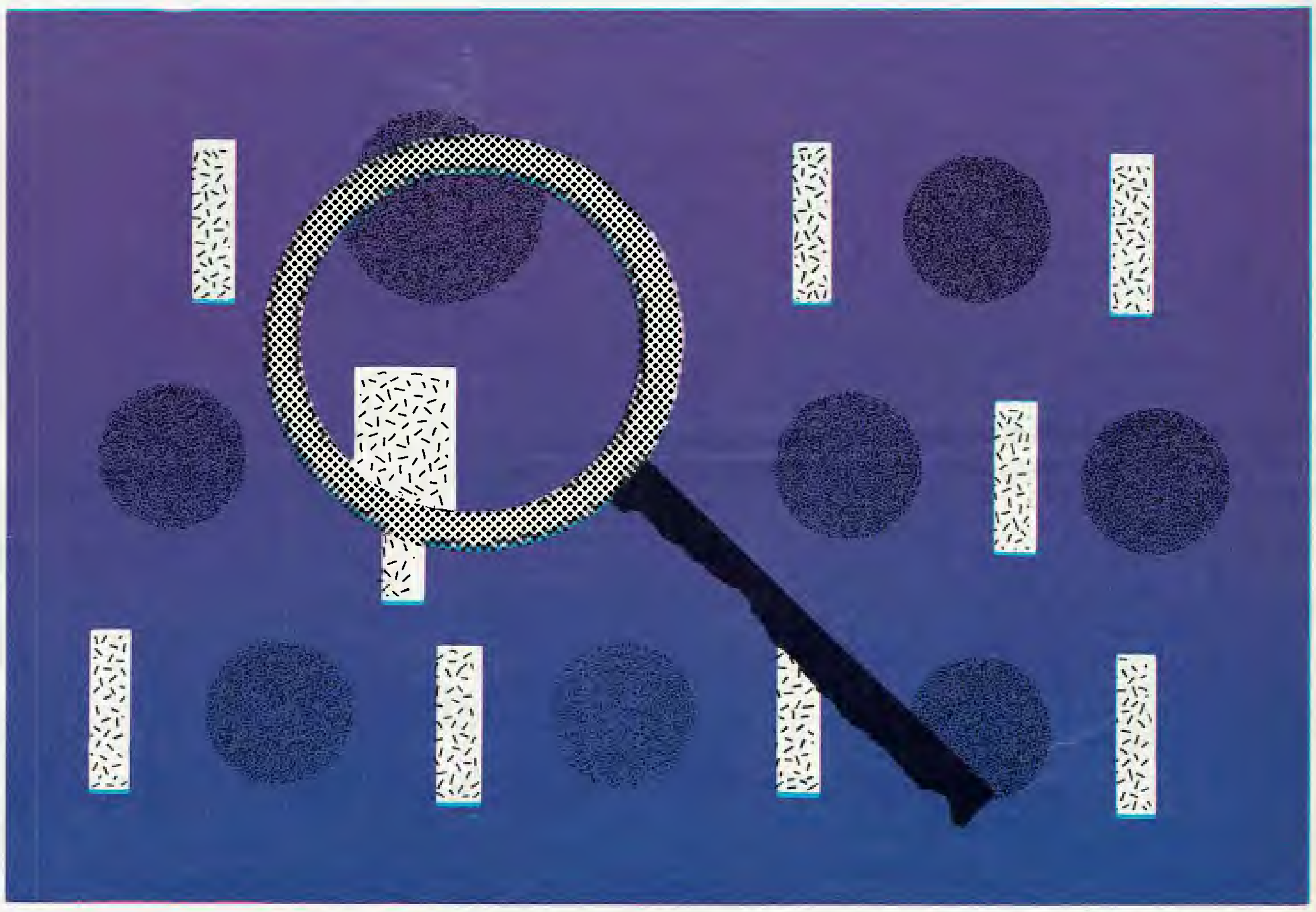
This article concerns itself only with the data management components, because they show how Lamda's product team have grasped an opportunity, missed by IBM, to build on the AS/400's raw promise. The article is based on demonstrations of the current release (2.5), study of the document, and discussions with key Aspect staff members.

Exhibit 1 identifies the aspects of Aspect's product which add value to the S/38-AS/400 data management environment.

Exhibit 1: Lamda's key data management features

- ■ Improved developer interface;
- ■ Improved user interface using the "access routes" concept;
- ■ Data validation rules stored in the data

(Continued page 20)



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191DR
A 14-inch monochrome display with mod 2 & 3 screen formats

These terminals provide this special capability – a COAX-A port and a built-in 3274 controller. This means you can install any of these terminals at a remote site and connect to your host through a synchronous modem. By the way, with this feature, nearly any low-cost ASCII printer attached to the terminal's aux port is host addressable. This remote feature eliminates costly controllers when your remote terminal requirements are small; and when you expand later, use the COAX-A connection. No modifications required! All connecting ports are basic features.

The 192C

PLUS THESE STANDARD FEATURES ...

Low Cost Printer Support: A parallel printer port uses a wide range of low-cost ASCII printers. Print your local screen, on a wide carriage, with color or with extended multinational character fonts.

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Bar Code, Mag Strip Reader Support: Beehive provides peripheral input support for bar code and mag strip readers throughout this terminal family.

Crosshair Rule: Extends cursor line to horizontal and vertical limits of screen.

Monitor Mode: Displays communication transmissions between the host and the remote terminal on request and monitors the display either dynamically or frozen. Your technical support personnel will enjoy this feature since solving network problems usually requires special test equipment.

Record/Pause/Play: Automates log-on/off sequences or recalls frequently used text. Any operator can learn to record a string, log-on and log-off sequences, or text information and zip through routine data entry tasks.

Extended User Diagnostics: Provides easy menu fault identification at the subassembly level.

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- Programmable software lock.

IDEA 197-2

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IDEA 197-PT

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- 5256 system printer emulation.
- 5219 emulation.
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Our Family approach really has the advantage – consider for the moment that we supply the complete 3270 product line with cost, features, benefits, and service equal to no one. Consider too, that a common base of subassemblies (power supplies, monitor boards, logic engines, and keyboards) make service and support economical. Beehive makes a conscious effort to reduce your costs for spares, training, and service overhead. The following features will give you the details:

Local Screen Copy: Use a wide range of low cost ASCII printers for local screen prints. This feature includes wide carriage support, color, and extended multinational character fonts.

Play/Record/Pause: automatic log-on and log-off, recall of text, and a storage capability of 3000 characters. Record 3000 characters in one PF key or distribute characters between all 24. A unique Beehive feature provides automatic multiple transmissions from a single PF key. Now you can accommodate multiple enter (transmission) sequences with a single key stroke. Our *pause* feature allows you to enter data between a playback routine. You can enter a password, a part number, or special codes before the playback continues.

Extended Video Highlighting: We've made field identification easier in both color and monochrome. Reverse video, underline, blinking, and combinations of each are available throughout Beehive's terminal family.

Menu Driven Set-Up: A full screen menu setup program that speaks your language (English, French, German, or custom) providing a friendly approach that really helps users. No cryptic line set-ups in Beehive terminals.

Extended User Diagnostics: provides easy menu fault identification at the subassembly level.

132 Column Color: Beehive's technology provides full native and emulation mode IBM 3192C/3179, seven and four color support. Beehive is currently the only manufacturer of a complete coax family to offer four screen sizes with a color terminal, including 43 row x 80 column and 27 row x 132 column.

Positive Screen: Beehive advanced display technology provides a 70Hz flicker-free white background with black characters in our 191E model. This display meets new European specifications and reduces user eye strain.

Calculator: This feature, optionally available throughout the product line, provides mathematical calculations in decimal, hexadecimal, octal or binary without host involvement. Use this feature anytime and enter the results to any screen field. A real productivity device for programmers, accountants, or others that need a calculator.

Light Pen, Bar Code, and Mag Strip Reader Support: Beehive provides this peripheral input support throughout its terminal family.

Integral Control Unit

- IBM 3270 network compatible BSC or SNA/SDLC Protocol.
- RS232 synchronous host port.
- ASCII printer support.
- All port parameters configured by screen menus – NO SWITCHES.
- Support for Printer Port Sharing and Escape Pass Through.
- Support for up to 32 logical devices (upgrade kit required).
- Asynchronous host support (upgrade kit required).

Display Station

- 14-inch anti-glare monitor.
- Full 3270 field formatting.
- 3274 status line icons.
- Large, readable screen characters.
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- Operating parameters configured with TCM™ (Terminal Configuration Manager).
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(Continued from page 17)

dictionary, not in the programs;

- Referential integrity rules stored in the DD, not in the programs;
- Less data redundancy, through definition of Virtual Fields in the DD;
- Active data dictionary, using a separate I/O module per file;
- Close support for database unload/re-create/re-load;
- Support for data analysis as well as data schema design.

AS/400 data potential boosted

On the S/38, data definitions had to be hand-coded in the DDS language using a standard editor. Some tasks, particularly the coding of complex user views, require considerable expertise. Although the AS/400 now provides a utility, IDDU, to assist the developer in capturing data definitions, this is not yet a mature product.

Lamda has addressed this problem, and provided a consistent and straightforward working environment for the analyst/programmer. A seasoned data processing professional meeting the product for the first time should have no difficulty in coming to grips with it. In modern parlance, the syntax reflects the semantics (or, as we used to say, form follows function).

User access is also made easier. A user always has an intuitive data model, even though it may be hazy, partial or quite inaccurate. Lamda provides the concept of "access routes" whereby the developer codes the real logical data model, and the software makes it available to users. The users' understanding is therefore repeatedly reinforced, and it is easy for them to compose data access commands, because the list of available fields is visible to them, and they can select the ones they want (subject to field-level security).

The power of the concept is especially noticeable in the application generation component, since it enables multiple screens and programs to be generated from a single user specification.

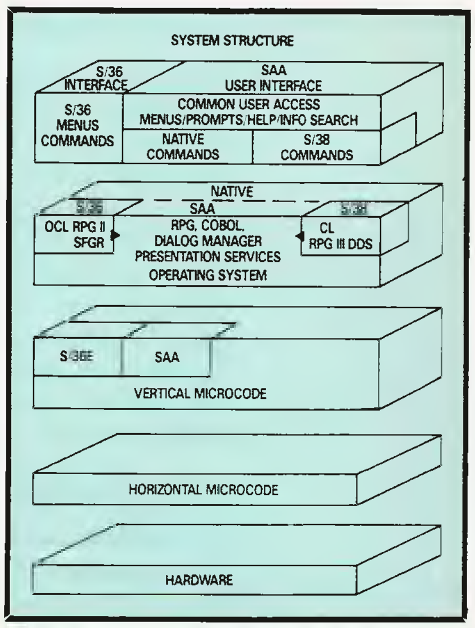
It is important to distinguish an access route from the more conventional concept of a "logical" or "user view". A user view implies that the records are joined at run-time, and as a result many records are read. Usually at least some of these reads are unnecessary, and execution-time inefficiency results.

An access route, on the other hand, assists user/programmers at development time. It serves to bring to their attention those records and items which have some kind of association with whatever record they started using. They choose the fields they want, and the software performs only such joins as are necessary, and avoids sending the disk read-heads into a spin, chasing unwanted records.

In addition to access routes, Lamda also supports the definition of logical views, so that a programmer or enduser can write his program as though the data was structured in a simpler (or just different) way than it actually is. Typically, a user will only be interested in a subset of the fields in a record, or a subset of the records in a file. More complex views involve "relational joins", which allow a user to think as though, say, a complete invoice were stored in one file (even though the data schema itself dare not be constructed that way, for fear of update anomalies).

Data validation is a crucial aspect of data management. Most 4GLs enable field-contents to be tested before they are recorded on the database. Tests are generally allowed against static ranges and lists, and dynamic tables and files. At least some form of conditional testing is generally available, such as, if customer-code = 3 or 9 and sales-tax-code not = 0 or 1, then reject with error-message 319.

But in the vast majority of products, field validation is embedded in the processing logic. Lamda enables validation rules to be stored in the data dictionary, rather than being part of some particular program. As a result, the designer can specify validation at any and all of three different levels, as shown in Exhibit 2.



The AS/400 architecture

Exhibit 2: Levels of validation specification

- Field: These tests are applied on the field, no matter which file it is contained in, in any program which tries to add, change or delete it.
- File: These additional tests are applied on the field, in any program which tries to add, change or delete it in that particular file to circumvent them, the file-level entry in the DD must be modified;
- Program: These additional tests are applied on the field within that program only.

By providing the ability to express validation rules in the DD, Lamda incorporates direct support for "referential integrity". This Ted Codd buzzword may sound pompous, but it is also vital. The essential thesis is that you can afford to let ignorant end-users (and ignorant programmers) write their own update programs, provided that the database protects itself.

The circumstances under which anyone can and cannot insert, change and delete data are part of the data scheme. Any programmer or user can add more validation rules in this programs, but he cannot avoid those which are already specified as part of the data scheme. For example, deletion of a customer-record can be precluded if an open order or invoice exists for that customer. No update program, even those written by clever and implicitly trusted super-programmers, will do anything which the data schema designer said was illegal.

As Exhibit 3 shows, Lamda provides a rich set of ways in which these validation rules can be expressed. In all cases, an error can be defined to exist because a

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> ‘ Complexity, cost and delay can all be dramatically reduced ’

Exhibit 3: Validation rules stored in the data dictionary

Type of Validation	Example
■ Simple checks:	
Content against format, including	
• date	supporting a variety of Gregorian formats
Content against pre-coded values	
• range(s)	1 to 6 (or 11 to 16)
• list	6, 7, 8, 9, 46, 17 or ‘X’
Content against dynamic values	
• code table or file	a lookup table maintained by a simple editor such as a table of valid sales-tax codes; or a file maintained by the application, such as the customer file;
■ Complex checks:	
• conditional logic	IF-statements containing conventional arithmetic and logical operators, and including boolean-and and-or; fields may be in any file or work-area
• user written program	separately compiled program, using the full power of any available language, including parameter passing.

match is found, or alternatively because no match is found. Referential integrity is supported by the last three.

Exhibit 3: Validation rules stored in the data dictionary

Another Lamda data management feature is support for “virtual fields”. Developers have appreciated for many years that less data redundancy means fewer errors. For example, a typical problem used to be the updating of the customer's address in one file but not in another. The modern approach to data schema design involves storing most data items in one place only, rather than in several.

But the conventional approach to data redundancy does not address the problem of data which is implied by other data. At its most trivial, grouping is sufficient, for example, where an account code comprises segments which define the company, the division, the region and the actual account. Another simple example is in re-formatting, for example, from Julian to Gregorian date.

A less straightforward example is date-of-birth and age. It is preferable that only the more fundamental data (in this case, date-of-birth) be stored, and age be computed (as system-date minus date-of-birth) each time it is needed.

Lamda enables dependent data to be defined in the data dictionary entry for a record as a “virtual field”, but not stored on disk, and only computed when a program actually uses it.

A complex decision

Of course, not all virtual fields are so straightforward. A complex decision such as whether a stock-item should be re-ordered can be pre-programmed, not as a loose piece of code in a program library, but as a virtual field defined as part of the file, yet only activated when that field-name is invoked. And, importantly, the field is defined where it should be — in the data dictionary, not in the process which uses it.

Another application is <invoice-total>, which is the sum of the values of the invoice's line-items. The <value> of each line-item could itself be a virtual field, the result of multiplying the real field <quantity> (from the line-item) by the real field <selling-price> (from the line-item or the products file, depending on the client's requirements). This is similar to the long-standing technique in batched data entry, of batch- and hash-totalling of important fields. Lamda provides a further facility specifically designed to support such “batch control logic”.

If the virtual field facility is used thoughtfully during application design and construction, the complexity, cost and delay involved in software maintenance can all be dramatically reduced.

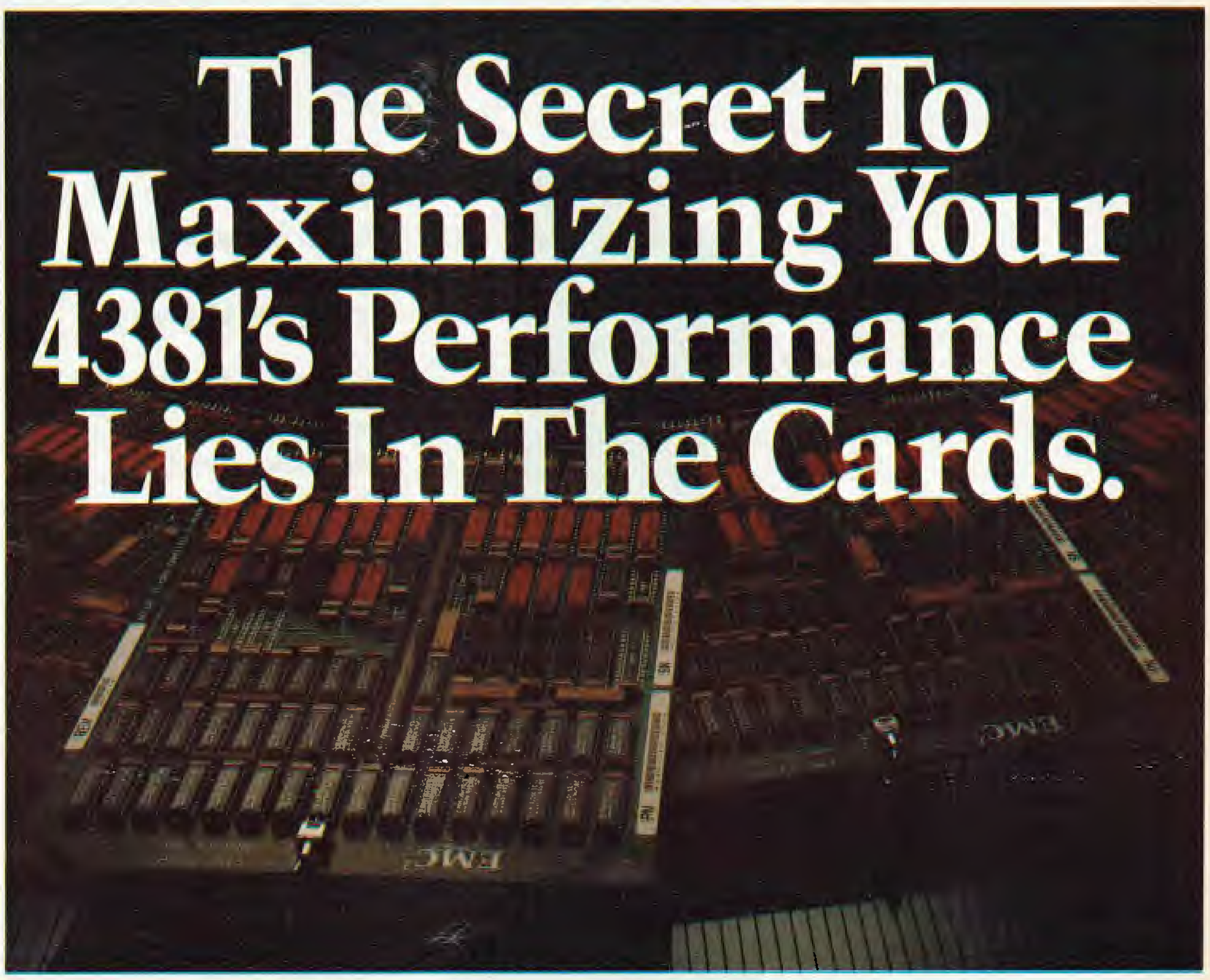
A further important feature of Lamda is that the data dictionary, the repository of information about the data scheme, is “active”. This involves an I/O module for each file, which has the relevant portion of the data dictionary compiled into it. Field- and file-level validation and the computation of virtual fields are performed by the I/O module, not by processing programs. Application programming is simplified, because programming tasks can take for granted both data-definition and data-handling.

The separation of I/O handling and validation from processing also means that programs generally need not be re-generated and re-compiled following data specification changes unless their processing specifications have been changed. Application maintenance is therefore significantly simplified, because the active data dictionary restricts to the minimum the amount of contingent change caused by a change to the data schema.

It is a fact of life that application software which provides close support to its users is frequently changed. Frequently, when a data schema is changed, it is necessary to unload the affected files, create a new version, and re-load the data. Aspect has recognised that this activity is operationally important, and Lamda incorporates direct support for it.

Lamda's next version is to offer a further feature. The data modelling component is to enable analysts to capture their entity-attribute-relationship model directly, iteratively extend and revise it, then convert it into the Lamda data model. The potential exists to dramatically shorten the time from data analysis to physical data specification, without compromising the quality of the data schema.

Lamda has built upon the AS/400's integral DBMS, and provided user organisations with a springboard for straightforward, clean and productive data management.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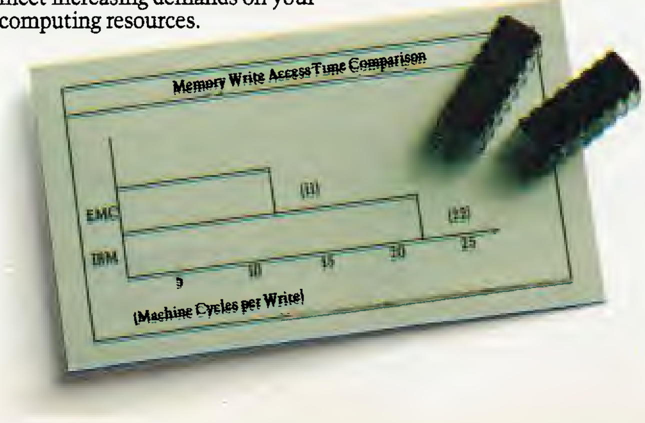

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Synon/2 lifts productivity

Wesfarmers Wool links an IBM System/38 with a Synon/2 generator to cut data entry time by 40 per cent

WESFARMERS Wool of Perth is a rural operation handling wool sales under the giant umbrella of Wesfarmers. The group contributes some $A150 million to the total corporate revenue of more than $A1000 million. In the course of its normal operations Wesfarmers Wool receives more than 220,000 bales of wool each year from a large number of producers and prepares them for regular sales by auction to international buyers.

Before the sales can take place the wool must be weighed, inspected, catalogued and stored in lots. The company's ability to offer the best possible wool broking service depends on the speed and administrative efficiency of the operation.

For more than 25 years Wesfarmers has been using IBM and compatible equipment for information processing and communications. Its central facility is a NAS mainframe some distance from Wesfarmers' headquarters, but linked to remote job entry facilities via a high speed dedicated line.

Operation of the wool broking system demands that wool store managers should have fast access to information about producers and buyers; wool received; preparation of wool for sales; auction sale catalogues; buyer invoices and producer sale accounts; buyer deliveries; and clip history and analysis.

By 1986 it has become obvious that the existing computer systems were no longer satisfactory for Wesfarmers Wool's needs. Under the computer system of the time, with remote processing via RJE, 3270E and DHCF, information input and retrieval was slow and cumbersome.

Late in 1986 Wesfarmers Wool undertook a review of operations in an attempt to find a more effective way of handling data input and processing and making key information immediately available where it was needed. The aim of the exercise was to improve service to wool producers and buyers, while also increasing throughput.

An ambitious implementation schedule was drawn up with the aim of having the core handling system fully operational by the beginning of the wool season in August 1987. The system was to be based on an IBM System/38, even though none of the core project team of a project leader, analyst and analyst-programmer, has System/38 experience.

A three-phase plan was created to implement the 10,000-hour wool broking system project. The first priority was to find a powerful set of project development tools and standards on which system development could be based. During March and April 1987, the company evaluated the Synon/2 application generator from the UK. The company ultimately decided to buy the system and immediately put it to work.

By May, 1987, the System/38 with 6M-bytes of memory was installed and work began on the second phrase of the project, coverign store handling, pre-sales and mainframe interface software. Development followed Synon/2's data-oriented approach, which is:

1. Data modelling is undertaken, including the definition of entities and the description of relationships to create an entity model.

2. Functional definition and analysis brings about the definition of structural requirements, definition analysis, and review of attributes and model to produce data/functional flow diagrams.

3. A model is created with defined files, field relationships, field reference conditions and database joins. The steps that follow are:

> ‘ Functions can be changed quickly and easily ’

4. Prototyping by creating and reviewing the system, and proposing diagrams of interactive and batch functions.

5. Access path analysis involving the review entity function diagram for performance with expected volumes.

6. Review of application design and generation of the physical database.

7. Complete functional specification.

8. Preparation of test data and definition of expected results.

9. Implementation of interfaces/conversion.

10. Transport of applications to target environment.

11. Implementation of the system.

Phase II of the system was completed on schedule. It involved the creation of 58 physical files, 154 logical files, 137 display files and 12 print files. In addition there were 137 Help text members, 181 RPG III programs and 16 Command Language programs.

Wesfarmers Wool believes the system reduced data entry time by more than 40 per cent, increased throughput and sales, and improved management information. In addition, it improved the services offered to wool producers, not least by producing paperwork as soon as the wool was received.

Manuel Comacho, project manager for Wesfarmers Rural Division, claims the use of the application development system has increased productivity of the DP team three or fourfold.

Its advantages are that it allows functions to be changed quickly and easily, produces documentation automatically, reduces development and testing time and reduces maintenance requirements.

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RDBMS not for novices

When leading construction and building group, John Holland, took the decision to restructure its accounting applications late last year it focused attention on migrating from an environment of conventional files and the limited use of a Codasyl database to the portability and flexibility of the relational database management system (RDBMS) Ingres. Ingres is the foundation for the accounting applications of all John Holland group companies. It runs under IBM's AIX version of Unix on a powerful IBM RT system. In this article David Landry, DP manager and project leader for the accounting application conversion, who has a strong background in relational database, said there are several major considerations for any organisation moving from a conventional or Codasyl environment to a relational one.

IT is a myth that genuine novice users can develop applications with a relational database management system.

The design for a relational database system should be considered the same as for any other database system. It is necessary to complete a formal requirements analysis and then proceed with an appropriate modelling technique. All these steps are critical to the success and further implementation of a relational system.

In designing a relational database system, if the requirements analysis is not properly undertaken, then the subsequent implementation of the system will never address the user needs effectively.

Following the requirements analysis phase is the modelling phase. There are several techniques available, of which I prefer data modelling. An extremely critical aspect of the data modelling is to normalise the entities and attributes that you have collected for your model to build your data structure diagram.

The database designer must have a full knowledge of normalisation. SQL joins anomalies will occur in a database if these issues are not addressed in the normalisation phase.

These normal forms are observed in relational database design and I refer readers to any appropriate text book for a further explanation.

Relational database claims its advantages over conventional databases in the design phase because the physical implementation of the database and specification is much closer to the logical model developed in the first stages of the database design.

> ‘The problem of outer joins may lead to waste’

Relational database table structures can be directly implemented for the extended Data Structure Diagrams. Another advantage here is ease with which these table structures can be altered once they have been implemented.

The second major issue for any organisation moving to relational technology is the SQL basis of an RDBMS like Ingres. This requires that programmers understand joins, projections, unions, and so on, all of which are part of the relational algebra concept.

While relational database syntax and code are easy to understand and readily produce reports, the problem of outer joins may lead to wasting a lot of development time.

For instance, at John Holland, we have a master table of suppliers and a detailed table of invoices. We produce a weekly report on all suppliers and their invoices. To produce this report would be a simple SQL Join of the supplier and invoice table on supplier number, but this would include only those suppliers that have invoices. To include any suppliers with no invoices the SQL language allows the specification of an outer Join. Unfortunately not all implementations of SQL support this feature. A simple solution to the problem is to insert a dummy invoice into the Invoice table for those suppliers not having invoices prior to producing the report.

Of course, having introduced a dummy invoice, then it has to be allowed for by subsequent procedures or removed after the report.

The use of SQL requires programmers to rethink totally their attitude to file handling techniques. For instance an SQL statement operates on sets of data (multiple rows) when performing various retrieval or database update activities. This is quite different from the typical 3GL approach where a file activity is performed on one record and it is the programmer's responsibility to write the appropriate procedural code to process a set or records.

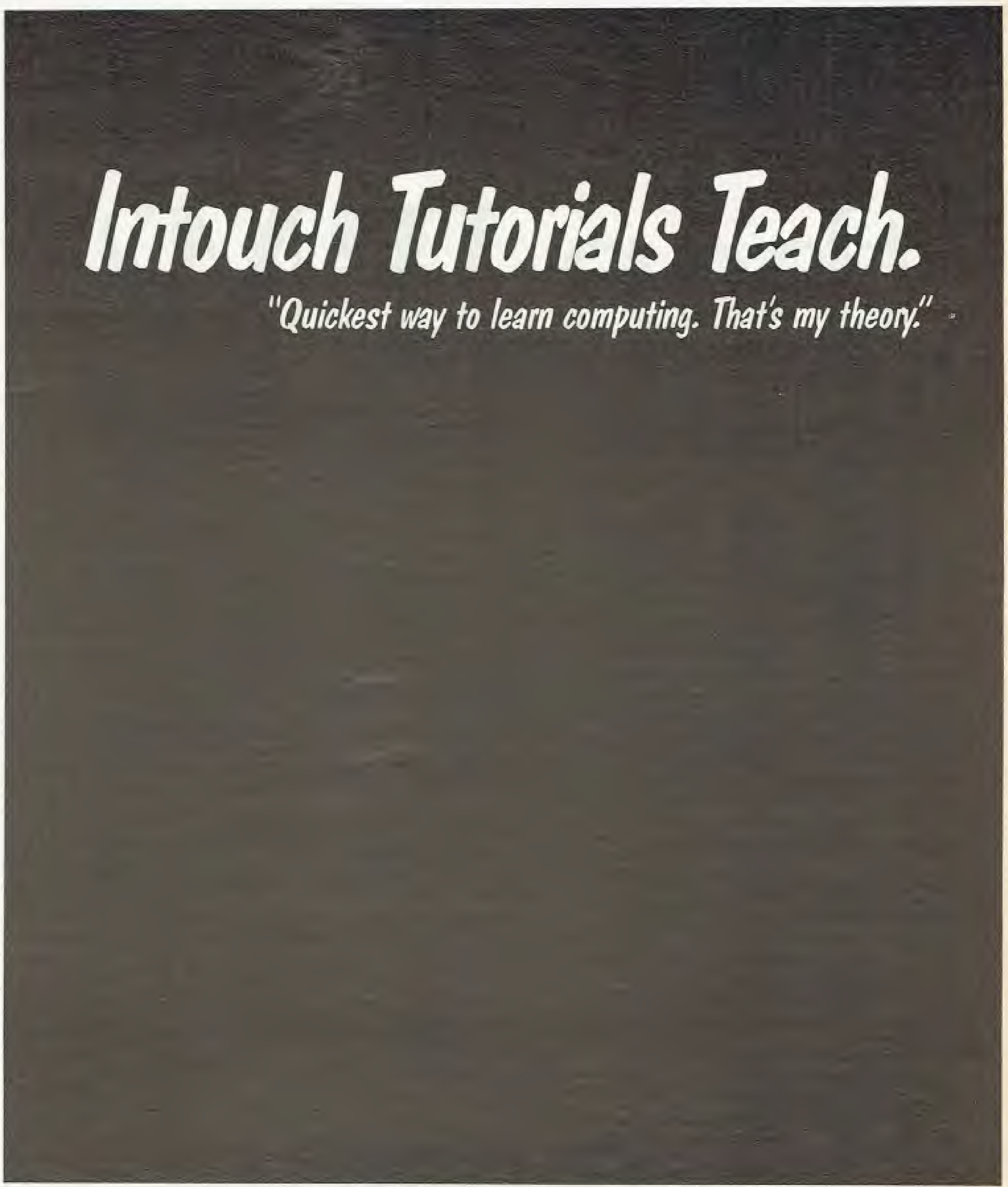
Once SQL concepts are understood, SQL power and simplicity of use come to the fore. Any SQL query can simply be validated and tested and refined before implementation into the appropriate procedures. This has a startling effect on development times, as database access code can be fully tested whilst developing procedures.

Furthermore, as is often required during the development process, a change is required to the database structure. These modifications usually involve adding additional fields to the various tables (files). There is no need to modify any of the previous developed queries if they have no requirement for these additional fields.

At John Holland our development time using the Ingres relational database has been approximately one third of that in a 3GL environment.

The benefit of moving to a relational database must be qualified by saying that all aspects of system design are critical to the ensuring success of the project.

One final point on the use of a relational database system is the selection of computer equipment. It is essential to benchmark a prototype or a subset of your intended system to measure the performance. The cost of a relational database is in its use of resources such as memory and processing power.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INTOUCH
TUTORIALS

Why IBM is powering into Pick

■ *Steve Kruse, vice-president of Pick Systems . . . enthusiastic*

THE cat is out of the bag. IBM Australia is making a strong push into the parochial world of the Pick operating system. Through Terry Leister, its recently appointed manager of Pick marketing, IBM Australia will thoroughly test the Australian Pick market, primarily through the RT platform. Steve Kruse, vice-president of Pick Systems, recently visited Australia and was most enthusiastic about the performance of the RT now — and in the future. He also spelt out some details of the concerted marketing push (CW, August 5, page 11). For IBM it is yet another arrow in its quiver of database offerings; another potentially lucrative market set firmly in its sights. Phil Considine of IBM's marketing contractor, Medrecord, spells out the significance of IBM's Pick entry:

IF IBM wants the Pick marketplace, it has the product and capability to take a large slice, said Phil Considine. Before IBM starts to market the Pick Open Architecture or Release 83 V2.2 product it claims advantages no other manufacturer can approach, he added.

At the PC end, the PS/2 runs Pick very well, and there are no problems meeting performance of 8088 or 8086 devices or 80386 PCs on the market.

The system 6150 (IBM's RT) is made for Pick. "Medrecord has installed a model 125 and it works better than any machine the company has seen," Considine claimed.

It is dangerous in the computer industry to believe anything in black and white, but Kruse has announced an A/400 direction for Pick that takes a business oriented hardware system and matches it with a business solution software system and a range to meet any needs, he said.

The System/88 will shortly join the Pick fault tolerant market as Stratus has signed a licence agreement. The System/88 is versatile, fast and transaction oriented for the banking market, Considine claimed.

The 9370 and 4381 both compete in the mid to upper ranges of the mini market. Both run Pick as a guest operating system.

"And if you wish, it runs on the 3090 as well," said Considine.

Even IBM could not migrate software over this array of environments and hardware, he said, but Pick systems worked unchanged on all of those systems.

> ‘ Medrecord is already looking at more than $A1 million in incremental business this year ’

The 315x terminals met Wyse, Freedom and others on performance and then have some spare capability, Considine said.

Medrecord's first installation of Pick Open Architecture (OA) was in the development section based in Perth.

Development manager Johanna Carlton said: "The 6150 system was incredibly fast in completing compiles of the largest systems — seven times faster than our present Ultimate 1525.

"Disk transfers are five times faster and back-ups are much easier," she said.

Considine said Medrecord was confident of meeting a target sales rate of four 6150 systems a month and has begun the task of porting the larger pathology laboratory, hospital, radiology and medical records systems to the Pick OA version IBM had endorsed.

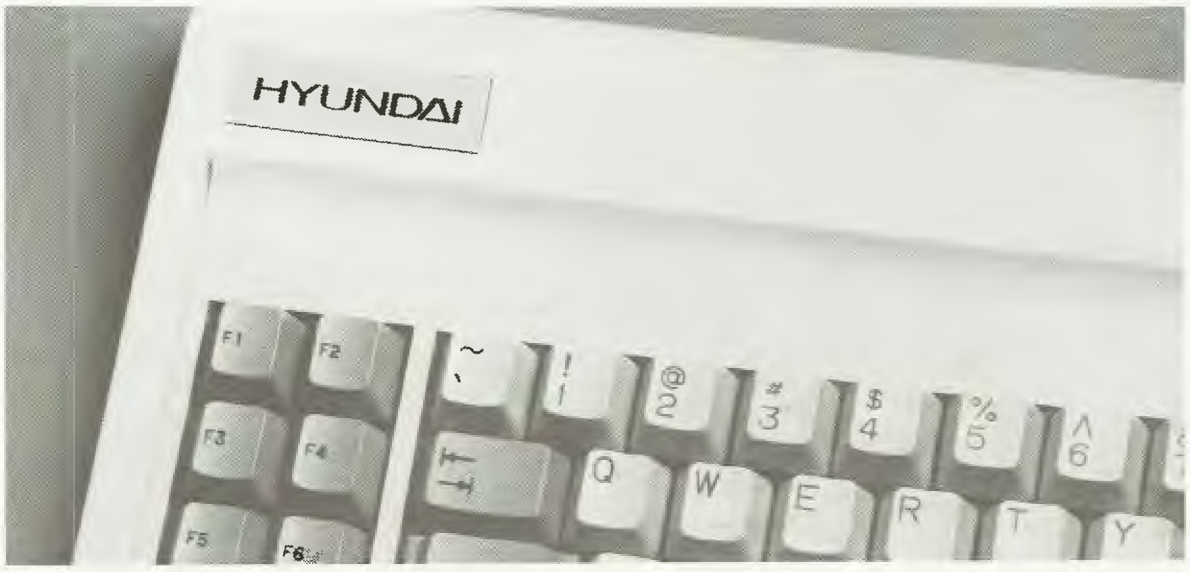
"We were not really motivated to change from R.83 to PC implementations of the Pick OA because there was little functional advantage," Considine said.

The Seattle Operating Systems developed the version of Pick for the RT, Pick Systems has since acquired an interest in the company, and it is possible that Seattle will produce Pick for IBM's AS/400.

"We are confident that we can be very successful with IBM. We are already looking at more than $A1 million in incremental business this year."

■ *Terry Leister . . . leading IBM's Pick drive*

More IBM than IBM?



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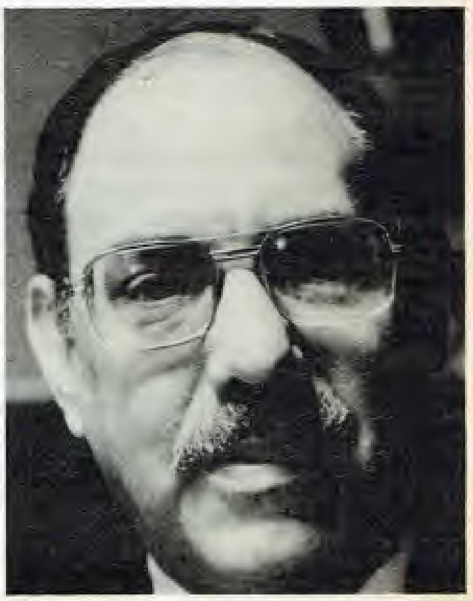
SQL is the key link

But Phil Dorn thinks too many cooks could spoil the broth when it comes to standardisation of this vital concept



■ ***Phil Dorn . . . what about the users?***

STRUCTURED Query Language, SQL, pronounced "sequel" by the cognoscenti in the database world,is a fascinating software product. Originally an IBM idea, SQL has escaped Big Blue's very protective shield and today lives a life on its own. SQL is a new generic. Like Fortran and Cobol before it, SQL belongs to the entire industry.

Lacking a sole proprietor means changes must be made through the standards mechanism. Therein arises a big problem. Too many cooks sure do stink up the broth. Most of the time they are so busy hitting each other they cannot even find the pot! Or the stove!

What is SQL? Simply put, SQL is the link between relational database management systems and applications programs. As SQL is now viewed, it serves as a means for defining data, a method to describe how the user wishes to manipulate data and a means for establishing security controls over the data. On many computer systems, SQL is the only available link aside from painful, expensive hand coding in Cobol or some other third generation language.

While it is all well and good for SQL to become an industry standard, what happens to the IBM users to whose systems SQL is fundamental? Who will listen to those users? Standards activity is dominated by vendors, representatives of various agencies and academics. The last person to whom they are likely to listen is a user, an employee of a live installation which exists to solve real world problems.

> ‘ Standards activity is dominated by vendors, various agencies, and academics ’

The IBM world divides into three primary systems: System/370, AS/400 and PS/2. Each architectural level has its own set of database tools, what IBM now calls "applications enabling" products.

At the traditional System/370 level are the hierarchical IMS and the relational DB2 with the auxillary products, DL/1 and SQL. Can SQL work with IMS? Technically, not very likely. SQL's design is centred on relational concepts.

On the AS/400 the hierarchical choice disappears. All data is organised by the built in relational database management system. Supplementing the DBMS are DDS, Data Description Specifications, IDDU, Interactive Data Definition Utility, DFU data file utilities, Query and SQL/400.

On PS/2 the customer has options. Either use Data Manager, which became available when OS/2 Extended Edition 1.0 was delivered, or use a separately purchased DBMS should one come to market. Data Manager comes with a Database Manager, which is none other than SQL for OS/2.

The connecting thread across all three architectures is SQL. How do we know this? This is not a question of what IBM is marketing today. Look at the products listed as complying with the rules of SAA, Systems Application Architecture. The inclusion of SQL is IBM's way of marking it as a critical product.

SQL has become a thriving industry. There are versions on computers as small as single user systems all the way up to supercomputers. Specialists in building database management systems early realised the requirement for a generalised retrieval language. The lengthy list of SQL implementations grows monthly. SQL is the primary tool to communicate with a great many popular, heavily used relational DBMSs, including (but not limited to) Oracle, Ingres, Supra, Informix and Unify.

It did not take long for SQL to blast through the usually tedious Ansi standardisation process. Some of the older Ansi standards had required five to 10 years to pass through the nightmarish bureaucratic maze, SQL had a quick and clean run.

The standard accepted two years ago, and its formal title is ANS Database language SQL X3,135-1986, was in place before most installations suspected they needed SQL. Only rarely are standards passed in anticipation of a need yet to come.

SQL is a real business. Books, articles and papers have been written and conferences organised around SQL. A great many tools have been built by independent software vendors to support the SQL environment. SQL even exists in the Unix world, a long way from its IBM birthplace.

As is often the case in the standards world, chaos has broken out on all fronts. In the standards process self-interest is the strong motivation of most vendors. Participation is viewed as a means to protect a marketing flank from attack or as a way to force competitors into major expenditures

(Continued page 34)

What's the greatest threat facing the computer today?

Australian and American experts agree on what it is, although their estimates of how much it costs you in downtime varies. Americans believe it accounts for more than 30% of all computer failures. Yet some Australians say their practical experience leads them to believe 70% would be a far more accurate figure.

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A buyers' guide

David Ward analyses the options available in the high-growth area of online transaction processing.

There is a vast number of products in the Vax/IBM marketplace, each claiming to be the ideal solution for every user's data processing requirements. Recent trends in hardware price/performance now make it possible for data processing solutions previously restricted to mainframe processing to be implemented at a departmental level, or in some cases, on the user's desk.

In discussing the issues in choosing a Relational DBMS for the high-growth area of online transaction processing, it is necessary to define our terminology as a basis for looking at the solutions which may be put forward.

By online transaction processing, I mean applications which are critical to an organisation and comprise the major focus of its business such as airline reservation systems, sharemarket trading, network problem resolution and network control, health care benefits systems, insurance claims processing systems, and so on.

Online transaction processing systems may include enquiry processing, but the major issues are throughput and response times in running transactions for a large number of users against large databases. In a typical online production application, usage is characterised by repeated execution of pre-defined transactions by a large number of simultaneous users. Online systems require updates — typically inserts, deletes, or changes to multiple tables.

Since integrity and availability of the data in an online system is mandatory, the system must be able to recover the data in a consistent state in case of failure. This requires that a transaction be treated as an atomic unit and either be completely committed to the database, or in case of a failure, completely eliminated from the database. Most DBMS systems use some form of locking and logging to provide this functionality. In addition, as a transaction executes, the DBMS must lock the records which are in use, to assure that the data is not changed by another user while the transaction is in progress.

By relational, I mean a DBMS with a very high level of conformity to the relational model of Dr Ted Codd. For the purposes of this article, only those DBMS with a relational fidelity of at least 7/12 will be considered as relational and merit discussion.

In addition, the relational model extensions covering integrity and distributed data are of far greater importance in the OLTP environment than in the more widespread use of relational DBMS for ad hoc decision support.

While a lack of integrity processing capability may be inconvenient when a user is querying a database, the ability to control the consequences of bad or inconsistent information are far worse where the information is being provided immediately to the customer as in an online missing persons' system.

By buyer's guide I mean an outline of issues against which a comparison of the alternative products can be carried out and a shortlist of prospective candidates can be created. The manner in which a feature is implemented is often just as significant as whether or not the feature exists. Often a vendor will attempt to provide a feature in an expeditious manner which unfortunately can negate the reason for the feature's implementation.

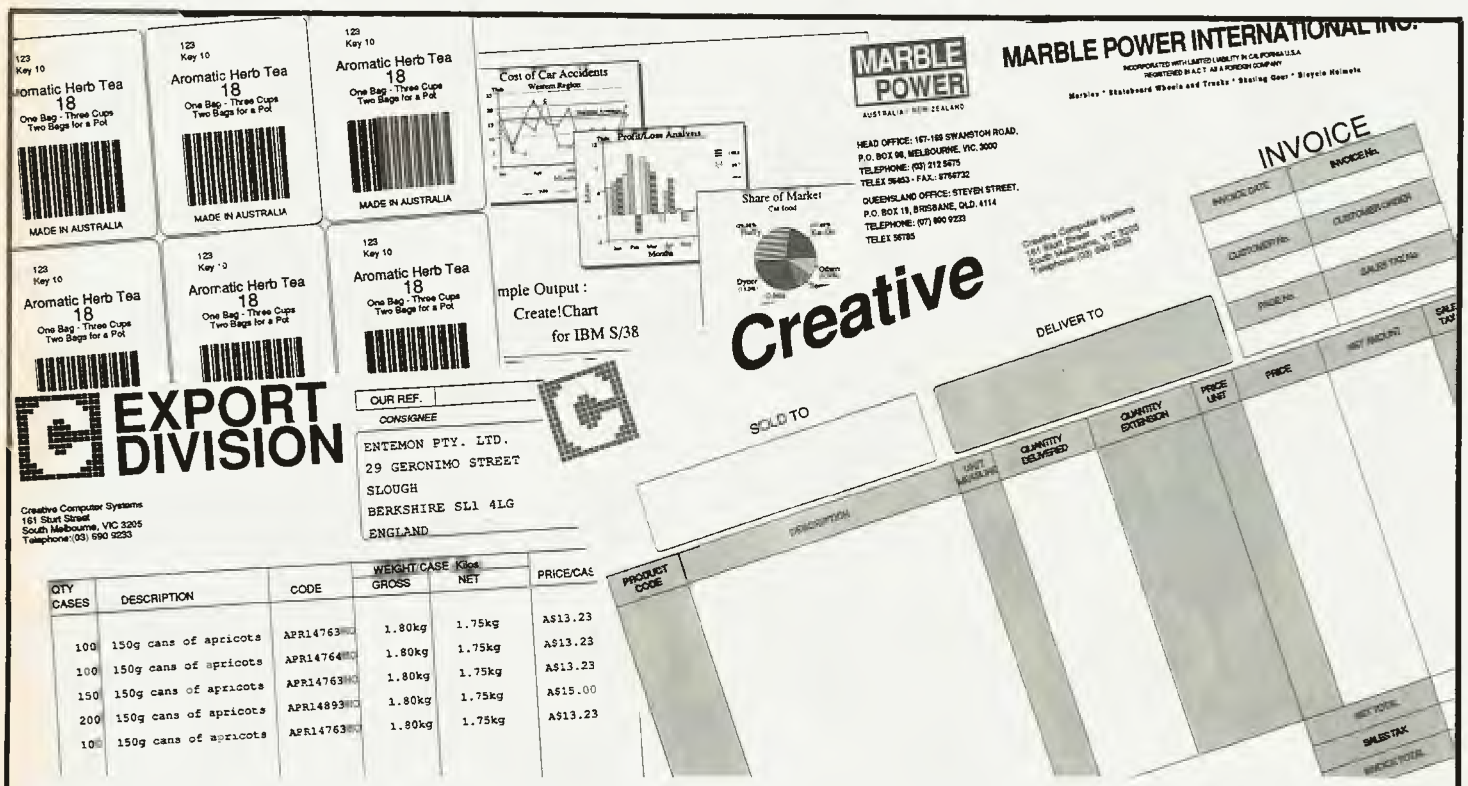
Against this background, the major areas we will look at are:
Performance;
Integrity;
Availability;
Productivity.

Performance

For OLTP, the best approach for determining relative performance is a benchmark simulating a banking environment known as the TPI benchmark. This is not a "standard" and special attention needs to be focused on the methodology used to implement the benchmark. Is it consistent with the real world environment that the TP1 is based on, or have the results been obtained by some other manner? Do the results provide for network overheads, locking, integrity and recovery processing?

Perhaps most important, "What exactly is the vendor benchmarking?" Is it a prototype version of a future release with characteristics supposing to be those of the "future" generally available product or is this a benchmark of a product which is installed and operational at over 50 per cent of the vendor's customer base. You, the reader, may have better fortune than I at predicting the future — but would you want to bet the financial performance and market image of your company on it? Prototype releases of all flavors, despite vendor's protestations to the contrary, are just that — prototypes, betas, whatever. Their performance can and should not bear any similarity to the final general release product.

The general release product will have a set of features which have been determined by market forces, research and development constraints and delivery timeframe. Performance is invariably one of the first casualties in getting features out the door. Prototypes may not have any debugging code, recovery or operating systems independence. They most certainly will not be stable to the degree of a general release (production quality) product. Are you prepared to "bet your business" on less than a fully tested "complete" general availability production version, which has been finalised and has passed all of the necessary quality assurance tests carried out by the vendor? Prototype or beta performance information is interesting as the potential performance of a future product; however, the OLTP world is based on what is available now, (installed and in production usage) in at least 50 per cent of the vendor's customers (not one or two). Only benchmark results which are from the vendor's general release should be the basis for capacity planning or information systems performance expectations.



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to RDBMS

Now that I have pointed out some of the pitfalls — what exactly should be measured and reported?

Throughput

Throughput and response time are the two most important performance issues to designers of online applications. Throughput is the rate at which transactions are processed through the system, usually stated in terms of transactions per second (trans/sec). In high performance online systems, throughput will reach a maximum and remain steady even as additional users are added to the system. In systems that are not well suited to the online environment, throughput reaches a peak and then drops off sharply as the number of users increases. The behavior of the throughput graph as users are added shows the ability of the system to handle peak loads.

Response time

Response time is what the user actually experiences — the elapsed time between hitting the enter key and getting a response back at a terminal. Response time should grow slowly as users are added to the system, and the growth should not be worse than a linear increase. In some systems, throughput can be improved up to a point, but only at the expense of degraded response time. Therefore, these two factors must always be reported together or else they are meaningless.

Number of simultaneous users

Another important factor for online applications, frequently overlooked when benchmark results are reported is the number of simultaneous users, and the change in both response time and throughput as users are added to the system. This information will give application designers an understanding of what will happen at peak load time and aid in capacity planning. In fact, response time, trans/sec, and number of users are so intimately related, that all three must be considered together.

Finally some of the other issues which must be verified for a realistic comparison are:

Transaction definition;
Hardware, software and configuration variables;
Verification of steady state;
Number of reads and writes to disk;
Consistency and repeatability;
DBMS startup overheads;
Set processing and arithmetic;
Query optimisation;
Compiled procedures versus SQL statements.

To be useful, benchmarks must be reduced to a common datum of trans/sec per Mips of processing power. While Mips ratings vary markedly between hardware vendors for a specific hardware platform, trans/sec/Mips will provide the most valid figure for an apples to apples comparison.

Caveat emptor benchmarks — No benchmark is worth its salt unless it has been completely audited and the vendor complies with a philosophy of full disclosure — meaning that source listings, configuration details and software/hardware dependencies are all disclosed and a vertical invitation is extended to the general data processing community to recreate the results themselves if they wish.

Once we can measure performance, what are the key factors? The key performance features that any serious contender from OLTP must have are:

Stored procedures. A stored procedure is a collection of SQL statements and control-of-flow language that can take parameters, define variables and execute conditional logic. Stored procedures offer two performance benefits: reduced network traffic and faster processing since they are already compiled and stored in the dictionary.

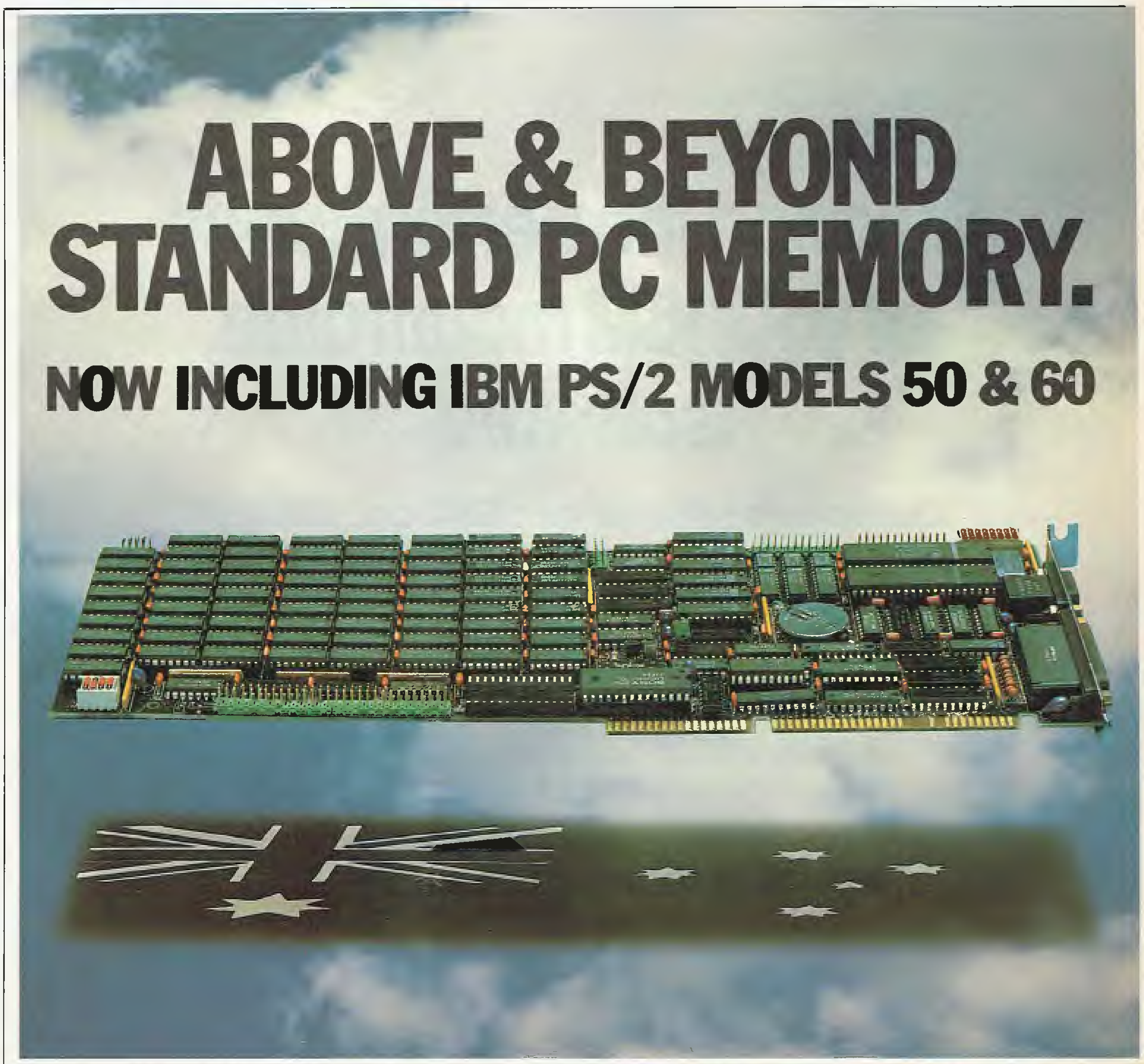
Shared procedure cache. The ability to provide common access to "stored procedures" in cache memory greatly reduces physical I/O and provides increased throughput.

Network optimisation. Procedures reduce network traffic by replacing many individual SQL statements (separate messages across the network) with a single call to the database management system.

Cost-based optimiser. A cost-based optimiser in contrast to a syntax-based optimiser uses database statistics to determine the use of indices and "join" strategies. Syntax-based optimisers usually have no knowledge of table size or data content.

(Continued page 28)

■ ***David Ward is managing director of Sybase***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A buyers' guide to Relational DBMS

(Continued from page 27)

Cost-based optimisers allow increased performance and greater efficiency of data access.

Shared commits. A "shared commit" scheme allows multiple transactions to commit with a single I/O to a shared log. In contract, other logging techniques require at least one physical I/O per transaction.

Multitasking kernel. A DBMS based on a true "client/server" architecture functions as a single process to the operating system, performing its own locking, scheduling, memory, and task management. The operating system is used only for disk I/O and networking. For performance-oriented applications, a machine can be configured with sufficient memory to hold the "server" in memory and completely eliminate page faults even with hundreds of simultaneous users.

Overlapped I/O. The DBMS should take advantage of the overlapped I/O mechanisms supported by the operating system. This feature allows control to be returned to the DBMS program (a DBMS Server) while the I/O request is being completed, thus allowing other tasks to be serviced.

Data Stored in Indices. Data stored in Indices (also called clustered indices) allows faster data access and reduced physical I/O by storing data at the leaf level of the index. Data access using a clustered index is almost always faster than using a non-clustered index.

Integrity

Integrity is an often-ignored, but vital ingredient in ensuring valid OLTP systems. A relational DBMS by definition should provide entity integrity at least; however, this basic feature is in an OLTP environment. The RDBMS must control the integrity of the application and data by reference to a rule base which is accessible at execution time for control of the application result. This need broadens the integrity requirement to include referential integrity and user-defined integrity support. The implementation of data integrity preserves physical and logical data independence and drastically reduces the cost and time of developing, modifying and maintaining applications. James Martin has stated that "in an online application as much as 75 per cent of programming time is spent on ensuring data integrity". A RDBMS designed for OLTP must eliminate this redundant programming and implement the business rules of the organisation to guarantee the validity of the data that the high-performance system will deliver.

Most database management systems enforce data integrity through programming at the applications level: the conditions that the data must meet in order to maintain data integrity are installed in each separate application. This practice leaves considerable room for error since there is no guarantee that a given applications programmer will provide adequate data integrity protection, nor is there any easy way to modify protections across multiple applications when the needs of the organisation change.

The RDBMS must also ensure data integrity with a number of other capabilities:

- Defining primary key and foreign key relationships to ensure referential integrity;
- Controlling data modification requests by validating values, by providing legal values and defaults, or by setting other conditions including time-defined items;
- Protecting database consistency with both user-defined and system-defined transactions which can be automatically rolled back if data integrity constraints are violated.

For integrity to be centrally controlled and to reduce application programming and maintenance effectively, all integrity must be enforced by the RDBMS itself, not the application program using the RDBMS! Otherwise the integrity of the online application is only as good as the application programmer's understanding of the business your company conducts. Particularly important is the support by the systems of missing or incomplete information (null values), domain support and cascaded processing which will automatically insert or delete information dependent on the outcome of processing and the transactions conformance to the business rules of the organisation. Thus the key issues for OLTP integrity support are:

Database enforced integrity. In contrast to application-driven integrity in which data integrity rules need to be repeated in each application, database enforced integrity allows definition of comprehensive business rules in the central dictionary. This provides consistency in applications and reduces maintenance costs when changes are necessary.

Domain support. This allows user defined "rules" to specify the legal values or datatype for a column in a table. Since different columns could have similar characteristics, domain support provides the ability to define these "rules" once and enforce them on a global basis across tables. This provides better consistency of data and lower development and maintenance costs.

Referential integrity. This means that for each distinct, non-null foreign key value in a relational database, a matching primary key value from the same domain must exist. This ensures that two items representing the same data remain consistent. Updates to foreign keys can be ambiguous and therefore require database-enforced "Business Rule Logic" to handle cascading inserts, deletes and updates.

Default support. A default is a user-defined value that the DBMS inserts into a column if no value is explicitly entered. The ability to express defaults within the data manager provides accurate and consistent data.

User-defined datatype. Since certain business rules are specific to an individual organisation, any DBMS should allow users to define their own datatypes. User-defined datatypes guarantee consistency of type, length, default, and rule definitions among all columns that use that particular datatype.

Nulls. Nulls correctly distinguish non-entries from any specific entry, including "0" for a number field or "blanks" for a character field.

Single table constraints. These constraints are similar to "rules" but only apply to an individual column within a table.

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'Availability and recovery'

Availability

Availability is an often misused term to describe the effect delivered by a combination of RDBMS features. Many RDBMS claim 24-hour availability to the user but then admit sheepishly that "well, yes, the system does have to be shut down for backups" or "yes, if the Dasd goes down the system won't operate". True availability implies sufficient RDBMS functionality to permit routine maintenance tasks like adding new users, tables, files or recovery without bringing the system down or restricting access.

A RDBMS designed for OLTP will also provide fault-tolerant processing capability and scaleability. Scaleability is the capability to add additional RDBMS servers into a network without disrupting the online application, thus transparently increasing throughput as workload demands. As more and more networks require distributed data, distributed data processing and distributed database, the necessity to support the 12 Rules for distributed database of Chris Date of Codd and Date Consulting, will arise. The foundation for this ability is a unique client/server architecture which enables client applications to access RDBMS servers across the network.

OLTP data is never static and thus any DDB solution must provide for update to distributed nodes. A vendor advertising a Distributed Database solution as read-only is really advertising the lack of a DDB architecture and the recovery requirements of DDB — which require a two-phase commit. Only one OLTP RDBMS vendor presently offers update to distributed servers supported by a two-phase commit capability. Additional mandatory features to justify true 24-hour availability are:

Automatic database recovery. Online environments require the DBMS to be able to provide quick recovery in the event of a hardware or software failure.

Mirrored databases. The ability to maintain mirrored versions of the database provides fault-tolerant availability in the event of media failure. This scheme is particularly useful where such support is not available through the hardware or the operating system.

Mirrored logging. Dual logging protects transaction integrity by maintaining mirrored versions of the log to guarantee fast, accurate recovery and fault-tolerant operation with no loss of committed transactions.

Physical logging for fast recovery. Physical logging requires fewer passes of the database to restore data lost at failure than does logical logging, which requires many passes in order to recover data. Reduced recovery time in turn allows greater availability of the online system.

Dynamic database and log dumps. This allows the database and transaction log to be backed up while the system is fully operational. The ability to process queries as well as updates results in continuous availability of the DBMS.

Dynamic column adds. This facility allows the database administrator to modify the schema for a table by adding columns while the DBMS is fully functional and servicing other users of the system.

Runtime procedure recompiles. For procedures to function effectively, the RDBMS must automatically detect changes (at runtime) and recompile any procedure in which one of the underlying objects has changed. This facility combined with "Stored Procedures" that reside in the database as objects provides added benefits in terms of consistency, performance and maintainability.

Server-based task control. Achieving high availability requires the DBMS to provide a stable environment and fast recovery in the event of a failure. The "client/server" architecture allows the DBMS to manage functions like scheduling, task management, and locking that are usually handled by the operating system. This gives the DBMS direct control over tasks and the ability to provide faster recovery mechanisms.

Online software diagnostics. Online diagnostics allow the database administrator to examine database objects and check the lock manager and the logical and physical consistency of a database while the server continues to process transactions.

Standby companion server. In a client/server-based DBMS, a "companion" is an inactive version of the primary server and is available to take over in the event of a failure of the node containing the Dataserver in a Vaxcluster.

Two-phase commit for distributed transactions. Distributed updates are more complex than retrievals because distributed updates need to ensure data consistency across multiple machines. A two-phase commit service is required to guarantee that any failure (hardware or software) will be automatically backed out by the DBMS.

Productivity

OLTP systems due to their emphasis on performance and complexity are often written in low-level languages like assembler or Cobol or PL/1; however, the rising costs of software development and the growing problem of software maintenance demand the development of high-performance OLTP systems using higher-level languages and design techniques such as Case, Protocycling and applications blueprinting.

In parallel with this trend, the availability of a new "PC-aware" class of programmers and endusers is demanding the user-friendly features of a PC and the language power and efficiency of a mainframe product. All RDBMSs are based on, or interface to, SQL and the SQL standardisation, which is occurring thoughout the computer industry, is generating a need for 4th generation languages to operate in SQL environments. Even the traditional 4GL vendors will produce varieties of SQL bridges to permit their continued viability in the marketplace.

Conclusion

OLTP is a unique environment for RDBMS, with a superset of specific requirements which must be designed for and implemented carefully to deliver a RDBMS which can address the users' needs. OLTP RDBMS is not a mere extension of existing technology, but requires a new design and architecture to address. The foundation of client/server design must incorporate the key features necessary to deliver OLTP levels of performance, integrity and availability.

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The Product Spotlight on S/370 Databases is based on information obtained during a survey of vendors conducted between July 1 and August 20, 1988. All details should be checked with the companies as listed.

The rise and rise of DB2 and its SQL/DS relative

IBM's DB2 and its relational cousin, SQL/DS are so successful in US mainframe shops that within a year IBM may enjoy as dominant a position in relational database management systems as it enjoys in mainframe teleprocessing monitors — a near monopoly.

The latest figures on licences sold for DB2 and SQL/DS boost their total higher than previously published numbers and indicate that their growth continues unabated three and five years after their respective introductions.

Shaku Atre, a consultant with ties to IBM's DB2 development facility, said 2800 licences had been issued for DB2 and 3300 for SQL/DS. Those figures illustrate that SQL/DS, while in DB2's shadow, has also won widespread acceptance on the mainframe arena, primarily, it is believed, among VM users.

Focus Research Systems cites a total of 450 DB2 sysems and 792 SQL/DS systems in its database. Those figures cannot be extrapolated to cover the whole market due to the danger of multiplying any builtin error, but they do reflect a high instalment rate of SQL/DS as well as DB2.

"It is only a matter of time before IBM will have sewn up the market," Atre said.

Martin Goetz, chairman of Syllogy Corp, said IBM had always enjoyed a 50 per cent to 60 per cent market share on the mainframe with its IMS and DL/1 products.

Adding DB2 and SQL/DS to the mix was likely to boost that percentage higher, probably to the 60 per cent to 65 per cent range, Goetz said. "If 70 per cent is considered a monopoly, they have a good chance," he predicted.

In the strictly relational marketplace, there are few mainframe contenders. Oracle Corp has still-unproven aspirations for that market, and Relational Technology's Ingres is limited to VM on the mainframe. Cincom Systems, is the one competitor that appears to have established a toehold, but the 432 licences sold for its Supra to date indicate that it is catching on slowly.

Cincom chairman Thomas Nies said it took several years to develop Supra and that companies just starting to develop a relational product would find the market had disappeared by 1992 or 1993.

Other companies — such as Goetz's former company, Applied Data Research, (ADR), Cullinet Software, and Software AG of North America — will provide SQL interfaces to their products.

However, surveys of buying intentions indicate that interest in nonrelational systems is rapidly falling off. According to Focus Research, the percentage of buyers "planning to buy nonrelational" has dipped from 91 per cent to 51 per cent in the past four years.

ADR spokesmen pointed out that not every mainframe customer wants to move to IBM's MVS/ESA, which is needed to run Version 2 of DB2, or buy IBM's most expensive hardware. The spokesmen said there will be a secondary market below DB2 for products with relational characteristics.

George Schussel, president of Digital Consulting, said that if DB2 and SQL/DS have achieved a dominant position, it is because IBM launched reliable and advanced products and the indpendent vendors are trying to catch up. With IMS, it was the other way around, he noted.

The independent companies will find ways to compete on application development tools and utilities and, to a limited extent, in DBMS as well. "IBM still falls short of a strangle hold," Schussel said.

"Users will be better off if it does not happen. We know from teleprocessing monitors that a competitive market is better than a monopoly," he added.

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Hierarchical databases are still high-volume workhorses

Many users find that old reliables have their place, says Barbara Sehr

IN an era of instant answers, instant recall and instant gratification, hierarchical databases may seem to some like a throwback to a period of valves and slide rules.

Despite the increased penetration of today's generation of relational databases, however, hierarchical databases remain the workhorse for intensive transaction processing users. Banks, insurance companies and other high-volume users continue to swear by the old reliable hierarchical databases such as IBM's IMS, which was developed in 1969.

Programmers find it easier to write applications within the relational environment. However, when compared with a 20-year-old process, relational products represent an untried and unproven technology in which limitations are still being discovered.

Focus Research reports 17.9 per cent of all mainframe users surveyed in January still use IMS. An additional 15.9 per cent use IDMS/R, a third-party hierarchical system from Cullinet Software.

Although the survey found that 57 per cent of all IMS users were also running IBM's newer relational product, DB2, these instances were described as "limited use." Many organisations, while willing to convert for certain isolated applications, remain steadfast in their belief that relational products are unsuitable for the bulk of their processing.

Relational products are immature, said Charles Plesums, acting director of systems research at United Service Automobile Association (USAA).

DB2 is used at USAA, he said, but only for minor programming functions. The heavy commitment is to IMS, and that commitment was recently reinforced through a five-year, $US120 million development program for one of the insurance giant's subsidiaries.

"Relational products are great for small shops with just a few hundred terminals," Plesums said, "but large shops like ours have to stick with IMS."

John White, vice-president of information systems and services at Texas Instruments. also said he has doubts about DB2 serving as a primary database management system in the short term.

"Development time is about a fifth of what it is under IMS," he said. But, he added, it could be 10 years or more before DB2 is ready to shoulder the burden of an intensive environment.

Like Plesums, White continues to depend on IMS to handle the majority of his processing requirements. T1 runs its complete operations, including inventory, accounting and manufacturing procedures, under IMS. It has done so for more than a decade and has just completed a 10-year corporate commitment to convert its operations to IMS, according to White.

There are two reasons IMS is still around, White said. The first is that the system has built up a huge library of applications in its nearly 20 years of availability. This library gives the relational database a life of its own.

For T1, a complete conversion to DB2 would probably mean an additional 10-year commitment, he said. "It may not take as long to write for DB2 as it did for IMS, but the flywheel is bigger — there are a lot more applications now."

> ‘ Relational products are great for small shops with a few hundred terminals, but large shops have to stick with products like IMS. ’

The second reason is related to IMS's ability to bear up under demanding applications. "The performance of hierarchical databases is simply so much better," White added.

Strong commitment to hierarchical databases among large users is not limited to the IBM mainframe market.

The fast-growing Vax market is an attractive target for makers of third-party relational databases, such as Ingres and Oracle. However, like IMS, hierarchical products within the Digital Equipment Corp Vax market date back to the origin of the Vax itself, and relational vendors are finding user loyalty tough to penetrate.

Gary Zander, group leader for information systems at International Flavors and Fragrances, said his company has used DRS, a hierarchical product from Advanced Data Management, from the time it acquired its first Vax more than 10 years ago. "DRS is significantly faster than relational products," Zander said.

As relational products acquire more muscle and maturity, a shift will eventually occur even in bastions of hierarchical DBMS, said James Russo, vice-president of marketing at Focus Research. But, he said, it will probably happen very slowly and over a long period of time.

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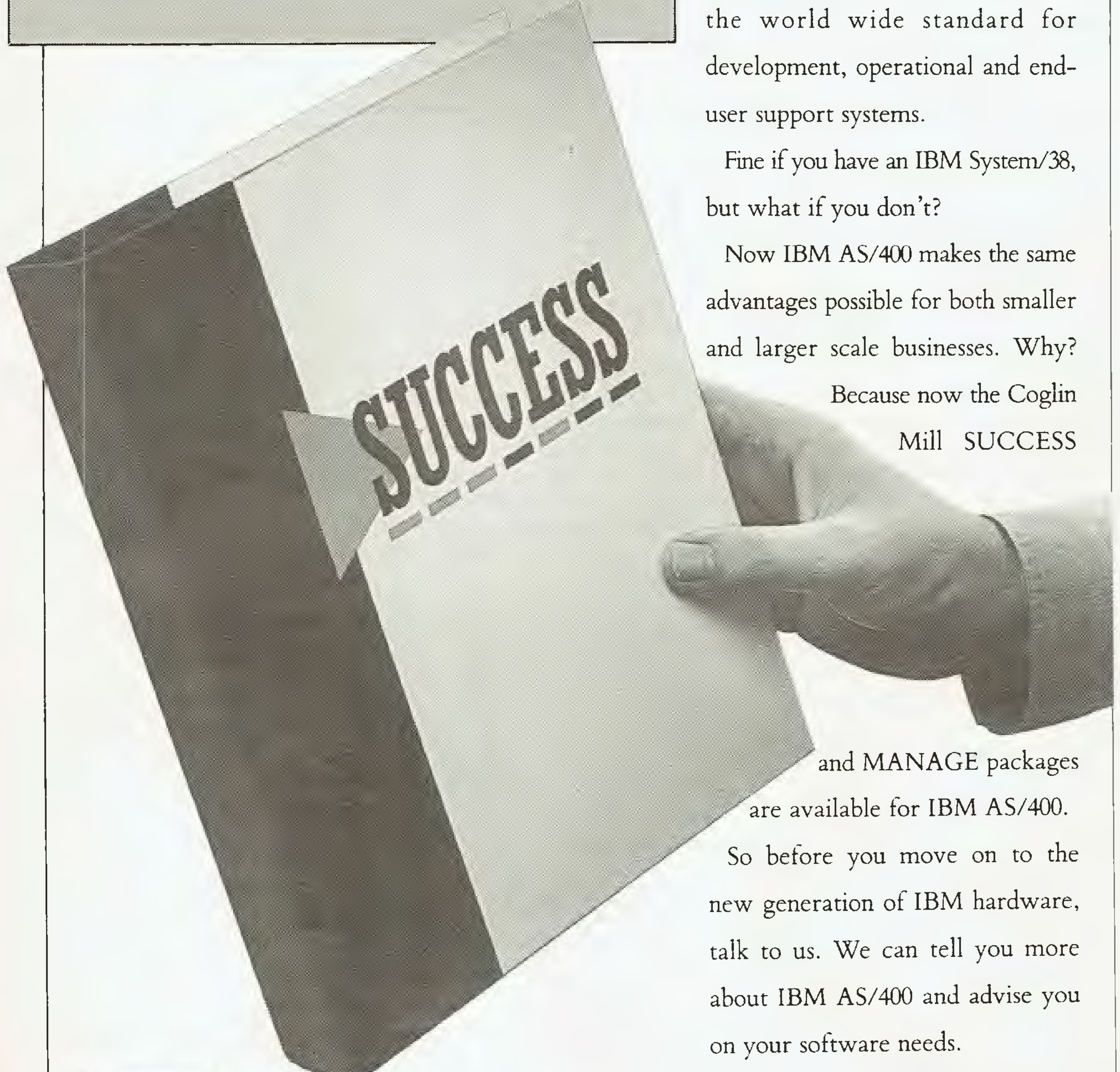

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Weighing the trade - offs

The vaporware in the personal computer database arena tends to hide the innovations that drive the marketplace. Fabian Pascal explains the silent revolution.

THE personal computer database management system market is undergoing a revolution similar to one that has already occurred at the mainframe level: traditional products must either adjust to the relational, SQL-based approach or give way to products that are based on it.

Adopting a relational strategy in the micro environment is not easy. The single-user, single-tasking Dos operating system with 640K-byte memory has constrained functionality, performance or both for SQL implementations. Vendors can mimic mainframe and miniversions but only at the expense of simplicity and ease of use.

Furthermore, the current Ansi SQL standard is weak. It lacks some basic capabilities and offers only limited support of others. The American National Standards Institute is only considering some critical relational features. This means vendors can either adhere to the Ansi standard and limit their competitive edge or add useful functionality and impose on their customers the risks associated with lack of standardisation.

> ‘The tendency has been not to deviate much from the de facto standard . . . which is a combination of Ansi and IBM's DB2 dialect’

In general, the tendency has been not to deviate much from the de facto "standard," which is a combination of the Ansi standard and IBM's slightly more functional DB2 dialect. Vendors have extended it into useful areas but have avoided fundamental relational features such as keys, domains, integrity and updatable views. Consequently, all commercial personal computer implementations are both subsets and supersets of the SQL standard.

There are, however, some important differences in how various vendors approach their micro strategies, especially in terms of connectivity. Because only genuine and relatively complete SQL systems will confer on users the full benefits of relational fidelity and standardisation, it is most important to look at products that fit this description.

Users should familiarise themselves with relational technology and SQL and beware of incomplete or highly proprietary implementations or of SQL interfaces placed on top of non-relational systems.

Oracle, in line with its aggressive multiplatform strategy, has ported its full mini/mainframe version of Oracle to the PC. The product is clearly targeted at developers and PC environments, as its considerable customisation, administration and tuning options attest.

PC Oracle's SQLplus dialect is broadly compatible with the de facto standard but is profusely extended. The product also offers some unique features such as row-level and recursive functions and extensions for physical space management.

The advantages of PC Oracle are portability of applications across supported platforms (of which there are many), more functionality and control and, for the vendor, simplification of development and support. On the other hand, the PC's architecture is not fully exploited externally. Internally, complexity baggage and extended memory requirements also limit the number of compatible machines.

Oracle is strongly committed to the micro market, and it appears that the company's connectivity strategy includes a local-area network server under OS/2 — IBM and Microsoft operating system for the Personal System/2 — and its distributed DBMS, SQL Star.

Informix Software has also ported its full minicomputer product to the PC, bringing it from Unix to Dos. The Informix SQL dialect, RDSQL, stays close to the current standard. Externally, the product is in tune with the PC environment, sporting a clean, integrated, Lotus-like menu interface.

In addition, the company's latest version of its SQL-based Informix 4GL offers a windowing capability and color. While it is not very resource demanding, the product is also not fully optimised for the PC.

Informix's commitment to the Dos platform has not been very clear, but the company has announced OS/2 support and offers a new SQL engine, Turbo, for the Unix environment. Connectivity is supported with a file server approach under Dos Netbios and with database servers under Unix/Starlan.

Relational Technology has taken a different approach with Ingres, also a product of mini/mainframe origin.

To minimise compromises on portability, performance and standard PC configuration, certain SQL functions considered to offer primary utility in a shared data environment can be included in PC applications. These take effect, however, only when ported to Ingres multi-user platforms.

Such features — for example, integrity, transactions and concurrency control — are called "no-ops". The core of Ingres SQL dialect is standard-compatible with the usual extensions, but no-ops are in Relational Technology's own relational language flavor, Quel, which is generally considered superior to SQL.

Since the Ingres front end was quite compatible with PC user expectations, Relational Technology preserved it. But the package was rewritten for, not ported to, Dos, with very good performance results.

Although an SQL engine has long been announced, Relational Technology has not been aggressive in the PC market. The company focuses connectivity on its advanced distributed DBMS, Ingres/Star, but gateways to other DBMSs — most recently Ashton-Tate Dbase IV — have also been announced.

Gupta Technologies has created in SQLbase a product written entirely for the PC but with explicit connectivity intentions.

For access to other SQL servers, Gupta kept its SQLtalk dialect close to the de facto standard and chose a server/requester architecture. Its PC orientation yields very good performance.

Gupta's approach commits the compa-

(Continued page 34)

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Weighing up the trade-offs

(Continued from page 33)

ny to the micro market, and support for OS/2 and Windows has long been announced. SQLbase is the first — and currently the only — Lan server to run under Dos Netbios. One IBM Advanced Program-to-Program Communications gateway to DB2, called SQLnet, is available, and similar plans exist for other mini and mainframe SQL servers.

Software Systems Technology XDb is the PC relational DBMS par excellence. Its SQL dialect is compatible with the standard and provides the usual extensions. It is the only DBMS whose design was done entirely with PC users, including endusers, in mind. It offers an integrated, well-designed set of menu-prompt-driven tools that are capable and extremely easy to use.

Various tests have consistently found the performance produced by XDb's explicit PC orientation to be significantly superior to the competition's. The company has anouced its intention to include referential integrity and a Lan server under Dos/Netbios.

In addition to these, a few new players have announced micro DBMS entries that are noteworthy. The SQL data manager embedded in IBM's OS/2 Extended Edition, Sybase's Dataserver and Lotus' Lotus/DBMS — an SQL Lan product — are certain to change the market equation.

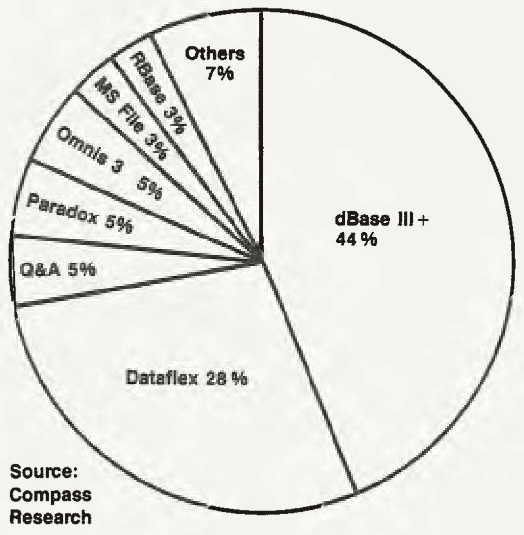
IBM's SQL data manager is rumored to initally provide limited tools but good compatibility with DB2. The Sybase Dataserver will have advanced relational features, and frontend support has been announced by Microsoft, Ashton-Tate and Sybase itself. Lotus/DBMS, with backing from Gupta, will also have an SQL Lan server/requester architecture.

These products and others that will be released in reaction to them are sure to change the market equation. Competition is going to be intense, characterised by claims of superiority.

But as this brief overview shows, PC users should approach the DBMS selection process with a good understanding of the trade-offs and how they relate to the needs of their specific environments.

- *Fabian Pascal is an independent analyst and consultant specialising in relational database management and SQL on micros. He is affiliated with the Codd and Date Consulting Group.*

dBase III + still leads database sales



Source: Compass Research

THE Australian PC database market has remained relatively stable over the past year, with database packages representing approximately 11 per cent of the total PC software market.

dBase III+ has consistently remained the clear market leader, although its share of the market has been eroded slightly by increased sales volumes of Dataflex.

Compass Research projects that the database market should continue in a similar pattern for the remainder of 1988, with dBase III+ maintaining its No. 1 position.

Based on sales made through third party resellers around Australia in February 1988.

Too many cooks can spoil SQL broth . . .

(Continued from page 25)

on implementing products with which they are not familiar.

While Ansi and ISO, the International Standards Organisation, agreed on the 1986 document, their views on changes being proposed for addition have begun to diverge.

SQL needs change. There are functional omissions from the current standard. Many syntactical expressions violate the "law of least astonishment" and lack symmetry and smoothness. Three levels of change are being considered. Addendum-1, SQL2 and SLQ3. Addendum-1 supports the extension for referential integrity already implemented by IBM in DB2 (the MVS/XA level SQL). The details of SQL2 and SQL3 are not public but it is known that both contain highly complex proposed extensions.

There is also another major bone of contention between Ansi and ISO over the proposed data dictionary standard. The two do not agree and each has its own proposal on the table.

Naturally, IBM is always prepared to muddy the waters. SQL as defined in SAA is only a paper standard, a target. The SAA version of SQL differs from all of IBM's implementations. The three IBM published versions, DB2 Release 3, SQL/DS (for VM/XA) and Database Manager, are not quite the same. At this writing details of SQL/400 are unknown but presumably it too, differs from its brethren. Bah!

> ‘ Where does it fit into the grand scheme? ’

X/Open has defined SQL for Unix systems, at least for those Unix systems that fit within the X/Open definition. As X/Open tends to reflect the biases of the European vendors who founded and dominate the organisation, it may be assumed their proposed standard differs from other public versions.

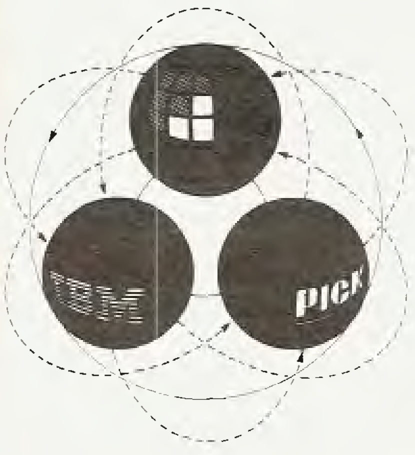
SQL is one of a handful of critical standards to come down the road. It may be as important as the 80 column card and ½in magnetic tape, both of which were approved in the 1960s, years after having been adopted as de facto standards by the user community.

As the importance of SQL continues to rise, it becomes more critical for installations to know what is happening to this product. Where does SQL fit into the grand scheme for computing in IBM's world today and tomorrow? What are the standard setters doing? User involvement is critical because SQL's mission is so vital.

Allowing the petty vendor jealousies and private agendas to destroy a major step forward would be tragic. It matters little if Ansi and ISO have a go at each other, it is always this way in the byzantine world of international standards. The playing field is very small and the game is political.

If the user community permits the politicians of Ansi and ISO to get away with introducing chaos into what was a positive and powerful step, a real disaster could occur. SQL is badly needed. Mismanagment of SQL's standardisation will cause long repercussions. Expensive revisions, retraining and conversions can be expected in a few years.

WORKING



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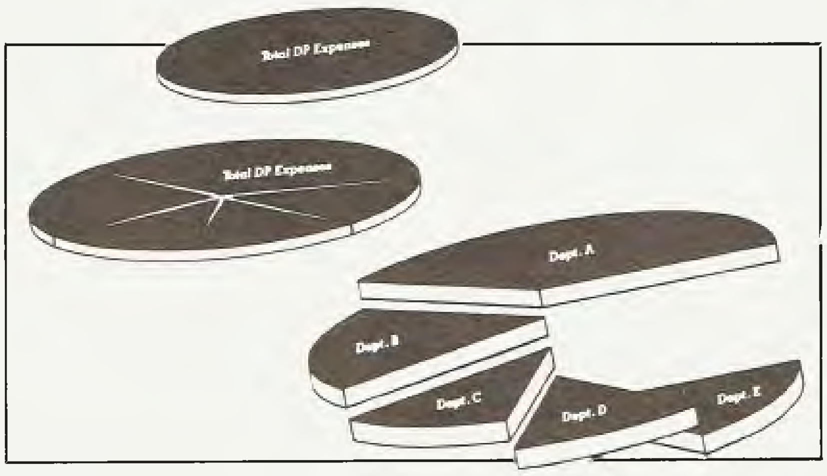

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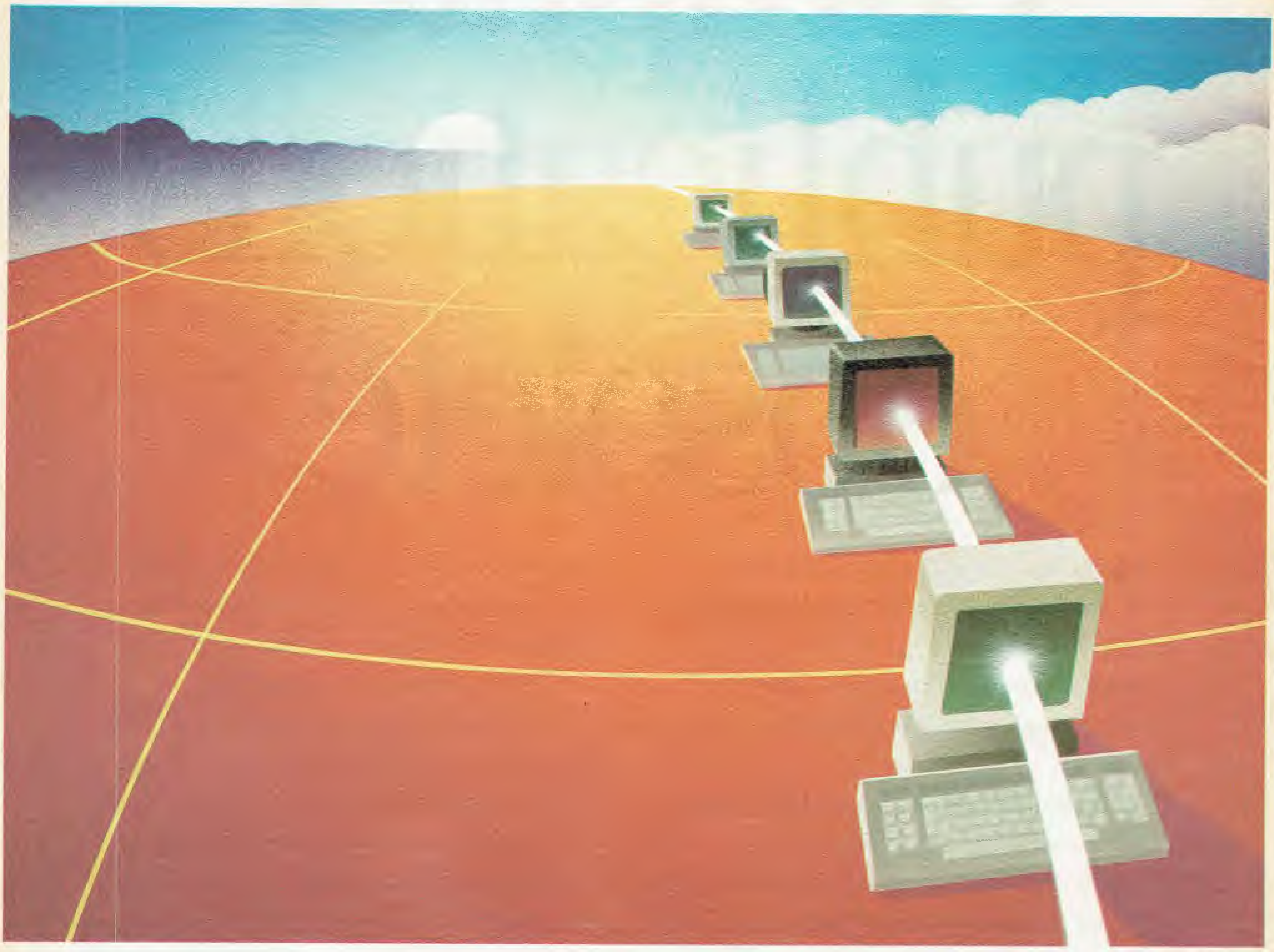

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